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Judd and Detweiler
Washington

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The George Washington University.

UNIVERSITY CALENDAR.

1906.

January 1, *Monday*.—Last day on which Theses may be presented for Graduation at the Winter Convocation.

January 20, *Saturday*.—Annual Meeting of the Alumni Association.

January 31, *Wednesday*.—Mid-Year Examinations completed in the Department of Arts and Sciences.

February 1, *Thursday*.—Second Term begins.

February 5, *Monday*.—Doctorate Disputation.

February 22, *Thursday*.—Winter Convocation.

April 13-16, *Friday* to *Monday*, both inclusive.—Easter holidays.

April 18, *Wednesday*.—Davis Prize Speaking.

May 1, *Tuesday*.—Last day on which Theses may be presented.

May 16, *Wednesday*.—Examinations for Degrees completed.

May 28, *Monday*.—Doctorate Disputation.

June 3, *Sunday*.—Baccalaureate Sermon.

May 28, 29, 31, June 1, *Monday, Tuesday, Thursday* and *Friday*.—Examinations for admission.

June 6, *Wednesday*.—University Commencement.

SUMMER VACATION.

September 19, *Wednesday*.—Fall examinations in the Department of Medicine.

September 17-21, *Monday* to *Friday*.—Examinations for admission.

September 26, *Wednesday*.—Academic Year begins in all Departments of the University.

November 29-December 1, *Thursday* to *Saturday*, both inclusive.—Thanksgiving recess.

RECESS FROM DECEMBER 23, 1906, TO JANUARY 2, 1907, BOTH INCLUSIVE.

1907

January 19, *Saturday*.—Annual Meeting of the Alumni Association.

January 31, *Thursday*.—Mid-Year Examinations completed in the Department of Arts and Sciences.

February 1, *Friday*.—Second Term begins.

1907.

February 22, *Friday.*—Winter Convocation.

March 29-April 1, *Friday* to *Monday*, both inclusive.—Easter holidays.

April 3, *Wednesday.*—Davis Prize Speaking.

May 1, *Wednesday.*—Last day on which Theses may be presented.

May 15, *Wednesday.*—Examinations for Degrees completed.

May 27, *Monday.*—Doctorate Disputation.

June 2, *Sunday.*—Baccalaureate Sermon.

May 27, 28, 29, 31, *Monday* to *Wednesday*, and *Friday.*—Examinations for admission.

June 5, *Wednesday.*—University Commencement.

CHRONOLOGICAL TABLE.

1799. George Washington's last will and testament, urging the establishment of a University in Washington.

1821. Charter granted by Act of Congress creating "The Columbian College in the District of Columbia."

1825. The Medical School organized.

1865. The Law School organized.

1866. Mr. W. W. Corcoran gave the Medical School a building, 1325 H street.

1872. Mr. Corcoran gave an endowment "to make the College an University."

1873. Act of Congress changing the name to the Columbian University.

1884. University building, Fifteenth and H streets, occupied by various departments of the University.

1884. The Corcoran Scientific School organized.

1887. The Dental School organized.

1893. The School of Graduate Studies organized.

1898. The Department of Jurisprudence and Diplomacy organized.

1898. Incorporation of the George Washington Memorial Association.

1902. Merging of the College, the Corcoran Scientific School, and the School of Graduate Studies into one Department of Arts and Sciences.

1902. Purchase of Van Ness Park as new site for the University.

1903. Conferences between representatives of the Washington Memorial Institution, the George Washington Memorial Association, and the Columbian University with a view to coöperation in graduate work.

1904. January 23. Act of Congress making the University non-sectarian and giving the Board of Trustees power to change the name.

1904. Suggestion of the George Washington Memorial Association that Columbian University change its name to The George Washington University, and its offer to erect a memorial building on the new site, at a cost of $500,000, for graduate study and scientific research, accepted by the Board of Trustees.

1904. September 1. Change of name to The George Washington University.

1905. February 22. First Winter Convocation of The George Washington University.

1905. Act of Congress authorizing the incorporation of colleges under the University charter.

1905. Organization under the University charter of the Columbian College, the Washington College of Engineering, and the National College of Pharmacy.

SOME IMPORTANT PROVISIONS IN THE CHARTER.

Degrees.—The Board of Trustees may confer "such degrees in the liberal arts and sciences to such pupils of the institution or others whom by their proficiency in learning or their meritorious distinction they shall think entitled to them, as are usually granted and conferred * * * and to grant to such graduates diplomas or certificates under the common seal * * * to authenticate and perpetuate the memory of such graduation."

(Act of Congress, 1821.)

A Board of Trustees, "consisting of twenty-two members. The President of the University shall be *ex-officio* a member of said Board, and the remaining twenty-one shall be divided in three classes with seven members in each class," the term of service being three years.

(Act of Congress, 1898.)

"The George Washington University shall have, and is hereby, given power to increase the number of its Trustees from time to time by two-thirds vote of the whole number of the Trustees at the time such vote is taken, to a number not exceeding forty-five."

(Act of Congress, 1905.)

Property and Endowment.—"Shall be competent and capable at law and in equity to take * * * any estate, in any messuage, lands, tenements, hereditaments, goods, chattels, moneys, and other effects, by gift, grant, bargain, sale, conveyance, assurance, will, devise, or bequest, of any person or persons whatsoever, * * * and the same to grant, bargain, sell, convey, assure, demise, and to farm let, and place out on interest for the use of said College, in such manner as to them shall seem most beneficial to the institution, and to receive the rents, issues, and profits, income and interest of the same, and to apply the same to the proper use and benefit of the said College."

(Act of Congress, 1821.)

"That power is hereby given the Board of Trustees * * * to change the name of said University, * * * and thereupon the University shall be known and designated by the name adopted, and by said new name the said University shall be vested with and convey its real estate, hold, control, and administer endowments and gifts of money and property heretofore and hereafter made for the maintenance of its educational work and do and perform all acts which it now has the power to do under its said charter. Such change of name shall not in any other way change, affect, or modify in any degree the rights, privileges, obligations, and powers of the said University under the charter of February ninth, eighteen hundred and twenty-one, and the amendatory acts thereto."

(Act of Congress, 1904.)

Non-sectarian.—"That persons of every religious denomination shall be capable of being elected Trustees; nor shall any person, either as president, professor, tutor, or pupil, be refused admittance into said University, or denied any of the privileges, immunities, or advantages thereof, for or on account of his sentiments in matters of religion."

(Act of Congress, 1904.)

Power to Organize Colleges.—"That by and with the consent of the said University, colleges may be organized hereunder for the purpose of carrying on, in connection with the University, special lines of educational work in the arts, sciences, and liberal and technical knowledge, such colleges to be educationally a part of the system of the University, but upon independent financial foundations, and to this end any five or more persons desirous of associating themselves for the purpose of establishing a college hereunder may make, sign, and acknowledge before any officer authorized to take acknowledgment of deeds in the District of Columbia, and with the assent of the University in writing, file in the office of the Recorder of Deeds of the said District a certificate in writing, in which shall be stated: * * * Upon filing such certificate the Trustees named therein and their successors shall be a body politic, incorporated by the name and style stated in the certificate, and by that name and style shall have perpetual succession in association with the University, with power in the college to sue and be sued; plead and be impleaded; to acquire, hold, and convey property in all legal ways; to receive by gift, devise, or otherwise, and hold, control, and administer endowments and gifts of money and property thereafter made to it for the maintenance of its educational work; * * * but said college shall not confer academic or honorary degrees; such college shall hold the property of the institution and all moneys and property conveyed to it by purchase, gift, conveyance, will, devise, or bequest solely for the purpose of the educational work specified in said certificate."

(Act of Congress, 1905.)

Affiliated Colleges.—"That said University may enter into affiliated agreements with any institutions of learning outside of the District of Columbia, for the purpose of giving to students of such institutions the educational facilities of said University, and the departments of the Government in the city of Washington which are by law open to students, upon such terms as are mutually agreed upon by the said University and the affiliated institutions."

(Act of Congress, 1905.)

Boards of Visitors.—"Said Board may also appoint a board or boards of visitors for any department or departments of educational work carried on by the University, such boards of visitors to be advisory only."

(Act of Congress, 1905.)

BOARD OF TRUSTEES.

The term of trustees expires, in each case, on Commencement Day of the year indicated.

STANDING COMMITTEES OF THE BOARD OF TRUSTEES.

1906-1907.

Executive: WOODWARD, GREENE, MATTINGLY, LARNER, GALLAUDET, EDSON, WALCOTT, NEEDHAM.

Nominations: GREENE, WOODWARD, PORTER, GALLINGER, BELL.

Department of Arts and Sciences: NOYES, GALLAUDET, MACFARLAND.

Faculty of Medicine and Hospital: RICHARDSON, LARNER, EDSON, YARROW.

Faculty of Dentistry: SHALLENBERGER, RICHARDSON, GALLINGER.

Department of Law and Jurisprudence: MATTINGLY, LARNER, MONTAGUE.

Department of Politics and Diplomacy: MACVEAGH, MATTINGLY, NEWLANDS, MACFARLAND.

Auditing Committee: CHAMBERS, PARKER, SHALLENBERGER.

Endowment: GALLAUDET, LEVERING, WOODWARD, GREENE, MACVEAGH, PARKER, NOYES, BELL, NEWLANDS, CHAMBERS, PORTER, GALLINGER, MACFARLAND.

COLLEGES OF THE UNIVERSITY.

Columbian College.

President of the University, *ex-officio* Member of the Board.

1906.

THOMAS R. JONES, DAVID A. CHAMBERS, THEODORE W. NOYES.

1907.

EUGENE LEVERING, EDWARD M. GALLAUDET, JOHN B. LARNER.

1908.

SAMUEL H. GREENE, SAMUEL W. WOODWARD,
WILLIAM H. SHALLENBERGER.

OFFICERS OF THE BOARD.

SAMUEL H. GREENE, Chairman. JOHN B. LARNER, Secretary.
EDWARD M. GALLAUDET, Vice-Chairman. JOHN JOY EDSON, Treasurer.

Washington College of Engineering.

President of the University, *ex-officio* Member of the Board.

1906.

JOHN B. LARNER, FREDERICK H. NEWELL, SAMUEL W. STRATTON.

1907.

THOMAS M. CHATARD, OTTO H. TITTMANN. T. CUMMERFORD MARTIN

1908.

BERNARD R. GREEN, CHARLES W. RAE, JOHN M. WILSON.

OFFICERS OF THE BOARD.

BERNARD R. GREEN, Chairman. JOHN B. LARNER, Secretary.
JOHN JOY EDSON, Treasurer.

National College of Pharmacy.

President of the University, *ex-officio* Member of the Board.

G. G. C. SIMMS, Phar. D.
SAMUEL I. HILTON, Phar. D.
FRANK P. WELLER, Phar. D.
SAMUEL WAGGAMAN, M. D., Phar. D.
CHARLES B. CAMPBELL, M. D., Phar. D.
HERBERT C. EASTERDAY, Phar. D.
FRANK C. HENRY, Phar. D.
H. E. KALUSOWSKI, M. D., Phar. D.
WALTER G. DUCKETT, Phar. D.
W. H. BRADBURY, Phar. D.
LEWIS FLEMER, Phar. D.
WILLARD S. RICHARDSON.

ADMINISTRATION AND INSTRUCTION.

Officers.

CHARLES WILLIS NEEDHAM, LL.D..........President of the University
OTIS D. SWETT, B.S., LL.M................Registrar of the University

President's Council.

CHARLES WILLIS NEEDHAM, LL.D..........President of the University
JAMES HOWARD GORE, Ph.D..................Professor of Mathematics
HOWARD LINCOLN HODGKINS, Ph.D................Professor of Physics
and Dean of Washington College of Engineering
JAMES MACBRIDE STERRETT, A.M., D.D.........Professor of Philosophy
CHARLES E. MUNROE, Ph.D................Professor of Chemistry and
Dean of the Faculty of Graduate Studies
HERMANN SCHOENFELD, Ph.D., LL.D.............Professor of German
CHARLES CLINTON SWISHER, Ph.D., LL.D.........Professor of History
WILLIAM ALLEN WILBUR, A.M...................Professor of English
and Dean of Columbian College
MITCHELL CARROLL, Ph.D.............Professor of Classical Philology
GEORGE NEELY HENNING, A.M........Professor of Romance Languages
PERCY ASH, C.E..................Professor of Architecture, in Charge
of Division of Architecture
C. WILLIAM A. VEDITZ, Ph.D., LL.B...........Professor of Economics
FRANK LEIGHTON DAY, Ph.D...........Professor of Semitic Languages
and Literatures, and Corresponding Secretary of the University.
W. F. R. PHILLIPS, M.D.............Dean of the Faculty of Medicine
J. HALL LEWIS, D.D.S................Dean of the Faculty of Dentistry
WILLIAM R. VANCE, Ph.D., LL.B......Dean of the Faculty of Law and
Jurisprudence
ERNEST G. LORENZEN, Ph.B., LL.B., J.U.D............Professor of Law
HENRY E. KALUSOWSKI, M.D., Phar. D...Dean of the National College
of Pharmacy

University Council.

Professors and Assistant Professors in all Departments and Colleges of the University constitute the University Council. Their names appear in the list of Members of Faculties and Teaching Staff.

MEMBERS OF FACULTIES AND TEACHING STAFF.

(Arranged, with the exception of the President, in groups, in the order of appointment.)

CHARLES WILLIS NEEDHAM, LL.D.........President of the University

Professors.

J. FORD THOMPSON, M.D........................Professor of Surgery
ALBERT F. A. KING, A.M., M.D., LL.D.........Professor of Obstetrics and Dean Emeritus of the Faculty of Medicine
THEODORE NICHOLAS GILL, M.D., Ph.D., LL.D.....Professor of Zoölogy
JAMES HOWARD GORE, Ph.D.................Professor of Mathematics
WILLIAM A. MAURY, LL.D........................Professor of Law
GEORGE N. ACKER, A.M., M.D.............Professor of Pædiatrics and of Clinical Medicine
HOWARD LINCOLN HODGKINS, Ph.D....Dean of Washington College of Engineering and Professor of Physics
CLEVELAND ABBE, A.M., LL.D..............Professor of Meteorology
HENRY C. YARROW, M.D...................Professor of Dermatology
JAMES HALL LEWIS, D.D.S..........Dean of the Faculty of Dentistry and Professor of Dental Prosthetics
D. KERFOOT SHUTE, A.B., M.D. ....Professor of Anatomy and of Clinical Ophthalmology
HENRY CLAY THOMPSON, D.D.S.......Professor of Operative Dentistry
WILLIAM P. CARR, M.D......................Professor of Physiology and of Clinical Surgery
JOHN MARSHALL HARLAN, LL.D....................Professor of Law
DAVID J. BREWER, LL.D...........................Professor of Law
WILLIAM F. R. PHILLIPS, M.D.........Dean of the Faculty of Medicine Professor of Hygiene and Assistant Professor of Practical Anatomy
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STERLING RUFFIN, M.D..........Professor of the Theory and Practice of Medicine and of Clinical Medicine
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WILLIAM K. BUTLER, A.M., M.D..........Professor of Ophthalmology
WILLIAM G. JOHNSON, LL.M........................Professor of Law
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JOHN VAN RENSSELAER, A.B., M.D.......Professor of Clinical Surgery
JAMES MACBRIDE STERRETT, A.M., D.D..........Professor of Philosophy
CHARLES EDWARD MUNROE, Ph.D................Dean of the Faculty of Graduate Studies and Professor of Chemistry
GEORGE P. MERRILL, Ph.D.........Professor of Geology and Mineralogy
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Harvey Washington Wiley, Ph.D., M.D. ... Professor of Agricultural Chemistry
Frank Hagar Bigelow, A.M., L.H.D. ...... Professor of Astro-Physics
G. Wythe Cook, M.D. .... Professor of Clinical Medicine
Herbert Louis Rice, M.S. .... Professor of Astronomy
Melville Church, LL.M. .... Professor of the Law of Patents
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J. Wesley Bovée, M.D. .... Professor of Gynecology
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James Carroll, M.D. .... Professor of Bacteriology and Pathology
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Francis R. Hagner, M.D. .... Clinical Professor of Genito-Urinary Surgery and Venereal Diseases
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Henry A. Pressey, Ph.D. .... Professor of Civil Engineering
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John W. Foster, LL.D. .... Professor of American Diplomacy
David J. Hill, LL.D. .... Professor of European Diplomacy
Martin A. Knapp, LL.D. ..... Professor of Interstate Commerce Law
Mitchell Carroll, Ph.D. .... Professor of Classical Philology and Director of University Publications
Paul Bartsch, M.S. .... Professor of Zoölogy
Edwin C. Brandenburg, LL.M. .... Professor of Law
Arthur Peter, LL.M. .... Professor of Law
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Albert L. Staveley, M.D. .... Clinical Professor of Gynecology
Henry P. Blair, LL.M. .... Professor of Law
Stanton J. Peelle, LL.D. .... Professor of Law
George N. Henning, A.M. .... Professor of Romance Languages
Percy Ash, C.E. .... Professor of Architecture, in Charge of Division of Architecture
John Paul Earnest, A.M. .... Professor of Law
Hannis Taylor, LL.D. .... Professor of Law
Oscar P. Austin .... Professor of Commerce
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J. Roland Walton, D.D.S. . . . . Professor of Prosthetic Technics
William A. White, M.D. . . . . Professor of Mental Diseases
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C. William A. Veditz, Ph.D., LL.B. . . . . Professor of Economics
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Albert Burnley Bibb . . . . Professor of Architecture
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Henry L. Abbot, LL.D., Brig. Gen., U. S. A. Professor of Hydraulic Engineering
Henry Parker Willis, Ph.D. Professor of Finance
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Alfred Nerincx, LL.D. . . . . Professor of Law
Edward Bennett Rosa, Ph.D. . . . . Professor of Physics
Frank Leighton Day, Ph.D. . . . Professor of Semitic Languages and Literatures, and Corresponding Secretary of the University
Charles H. Clark, M.D. . . . . . . Clinical Professor of Nervous Diseases
Arthur A. Snyder, M.D. . . . . Clinical Professor of Surgery
I. W. Blackburn, M.D. . . . . Professor of Morbid Anatomy
Albert Mann, A. M., Ph.D. . . . . Professor of Botany
Samuel Waggaman, M.D., Phar.D. . . . . . Professor of Materia Medica, Botany and Toxicology
William F. Hillebrand, Ph.D., Phar.D. . . . Professor of Chemistry and Physics
Frederick A. Holton, B.S., Phar.D. . . Professor of Analytical Chemistry
Henry E. Kalusowski, M.D., Phar.D. . . . . Dean of National College of Pharmacy and Professor of Pharmacy
Burton J. Howard, B.S. . . . . Professor of Microscopy

Assistant Professors.

Edward Adams Muir, B.S. . . . . Assistant Professor of Graphics
Edward E. Morse, M.D. . . . . Assistant Professor of Obstetrics
Edward G. Seibert, M.D. . . . . Assistant Professor of Chemistry
William H. Trail, D.D.S. . . . . Assistant Professor of Dental Materia Medica
Charles Ray Dean, M.Dip. Assistant Professor of European Diplomacy
Nevil Monroe Hopkins, Ph.D. . . . . . Assistant Professor of Chemistry
John W. Holcombe, A.M., M.Dip. . . . . Assistant Professor of Comparative Politics

Charles Sidney Smith, A.M...Assistant Professor of Greek and Latin
Julian M. Cabell, M.D.............Assistant Professor of Obstetrics
Philander Betts, E.E....Assistant Professor of Electrical Engineering
Edwin A. Hill, Ph.D..............Assistant Professor of Chemistry
D. W. Prentiss, M.D...............Assistant Professor of Histology
C. S. White, M.D................Assistant Professor of Physiology
Carl Hau, A.M., LL.B.................Assistant Professor of Law
J. F. Mitchell, M.D........Assistant Professor of Surgical Pathology
Thomas Malcolm Price, Ph.D.......Assistant Professor of Chemistry
L. H. Taylor, M.D...........Assistant Professor of Physiology and Instructor in Clinical Medicine
John R. Wellington, M.D....Assistant Professor of Clinical Surgery
John H. Lindsey, M.D.............Assistant Professor of Pathology, Curator of the Pathological Museum
Timothy W. Stanton, Ph.D......Assistant Professor of Paleontology
Ray Smith Bassler, M.S......Assistant Professor of Paleontology and Stratigraphical Geology
Sherman M. Woodward, M.S., M.A......Acting Assistant Professor of Mechanical Engineering

Instructors, Demonstrators and Assistants.

Samuel H. Greene, Jr., M.D................Instructor in Anatomy
Homer S. Medford, M.D....................Instructor in Obstetrics
L. H. Reichelderfer, M.D..................Instructor in Medicine
Edgar P. Copeland, M.D....................Instructor in Surgery
J. L. Riggles, M.D........................Instructor in Anatomy
T. S. D. Grasty, M.D........Instructor in Bacteriology and Pathology
H. C. Macatee, M.D....Instructor in Medicine and Clinical Instructor
G. Brown Miller, M.D....................Instructor in Gynecology
George M. Ruffin, M.D....................Instructor in Anatomy
Levi Russell Alden, A.M...................Instructor in History
John Wilmer Latimer, LL.B................Clerk of the Moot Court
F. L. Molby ....Instructor in Freehand Drawing
Oscar Quick, A.M..........................Instructor in Physics
Paul Noble Peck, A. M...................Instructor in Mathematics
H. H. Donnally, M.D...............Instructor in Bacteriology and Pathology and Assistant in Clinical Laboratory
O. A. M. McKimmie, M.D......Clinical Instructor in Laryngology and Ophthalmology
H. S. Dye, M.D., Clinical Instructor in Laryngology and Ophthalmology
Eugene Le Merle, M.D...Clinical Instructor in Nervous Diseases and Assistant Demonstrator of Bacteriology and Pathology
Otis D. Swett, B.S., LL.M................Instructor in Chemistry
Isaac Allison, B.S., E.E..................Instructor in Graphics
De Witt C. Croissant, A.B..................Instructor in English

Oscar L. Keith, A.M. .... Instructor in Romance Languages
Henry R. Elliott, M.D. .... Instructor in Physiology
Walter H. Merrill, M.D. .... Instructor in Electro-Therapeutics
Walter F. Dodd, Ph.D. .... Instructor in Political Science
Alfred F. W. Schmidt, A.M. .... Instructor in German
Edward M. Dawson, Jr., B.S. .... Instructor in Modern History
Ashton Waugh McWhorter, Ph.D. .... Instructor in Greek and Latin
Edwin V. Dunstan, B.S. .... Instructor in Civil Engineering
Adolph A. Hoehling, Jr. .... Associate Justice of the Moot Court of Appeals
Asaph Hall, Ph.D. .... Instructor in Mathematics
A. B. Ilsley, B.S. .... Instructor in Civil Engineering
B. M. Randolph, M.D. .... Instructor in Pharmacology
Charles Mason Remey .... Instructor in Architecture
Charles M. Beall .... Instructor in Physical Diagnosis
Harry C. Coburn, M.D. .... Instructor in Physical Diagnosis
Charles T. Bassett, D.D.S. .... Demonstrator in Charge of the Dental Infirmary
Huron W. Lawson, M.D. .... Demonstrator in Bacteriology and Pathology
Cadmus Linden Odor, D.D.S. ...... Demonstrator of Operative Technics
Frederick I. Bartlett .... Technic Demonstrator
Allen S. Wolfe .... Technic Demonstrator
Charles L. Bovée, D.D.S. .... Demonstrator in the Dental Infirmary
Joseph Wood Pollock, D.D.S. .... Assistant Demonstrator in the Dental Infirmary
Arthur Millard Trivett, D.D.S. ...... Assistant Demonstrator in the Dental Infirmary
Thomas R. Wilkerson, D.D.S. .... Assistant Demonstrator in the Dental Infirmary
George B. Heinecke, M.D. .... Assistant Demonstrator of Anatomy
Virgil B. Jackson, M.D. .... Assistant Demonstrator of Anatomy
Edward Elliott Richardson, M.D., M. S. .. Assistant Demonstrator of Anatomy
W. A. Frankland, M.D. ..... Assistant Demonstrator of Anatomy and Clinical Gynecology
R. M. Little, M.D. .... Assistant Demonstrator of Anatomy
Joseph D. Rodgers, M.D. .... Assistant Demonstrator of Anatomy
Edwin Smith, Jr. .... Assistant in Chemistry
Raymond Outwater, M.S. .... Assistant in Assaying
J. Lawn Thompson, M.D. .... Assistant in Minor Surgery
C. L. Davis, M.D. .... Assistant Instructor in Histology
Henry M. Jewett, M.D. .... Assistant Instructor in Histology
William E. Hillyer, M.S. .... Assistant in Chemistry
Otto L. Veerhoff, B.A. .... Assistant in German

Henry Vernon Johnston ....Pharmacist in the Hospital
Elmer Slayton Newton, M.D................Assistant in Chemistry
Arthur N. Tasker ....Assistant in Chemistry
W. R. Brandenburg......Demonstrator of Bacteriology and Pathology
H. P. Parker, M.D........Demonstrator of Bacteriology and Pathology
Ernest W. Brown..........................Assistant in Chemistry
J. A. Holmes, M.D..................Assistant Instructor in Histology
E. T. M. Franklin ....Assistant in Minor Surgery
W. J. French ....Assistant in Minor Surgery
A. L. Hunt ....Assistant in Minor Surgery
Charles W. Hyde ....Assistant in Minor Surgery
Truman Abbe, M.D................Assistant Instructor in Physiology
Hubert P. Illman ....Assistant in Architecture

Lecturers.

Otis T. Mason, LL.D......................Lecturer on Anthropology
Thomas M. Chatard, Ph.D.........Lecturer on Chemical Engineering
William T. Harris, LL.D......Lecturer on the Philosophy of History
Carroll D. Wright, LL.D.................Lecturer on Statistics and Social Economics
N. W. Hoyles, K.C.........................Lecturer on Canadian Law
Robert M. Hughes, A.M., LL.B.......Lecturer on Admiralty Law and Procedure
Joseph M. Heller, M.D..........Lecturer on Diseases of the Tropics
Edgar Buckingham, Ph. D............Lecturer on Thermodynamics
Frederick E. Fowle, Jr., S.B..............Lecturer on Astro-Physics
James C. Monaghan, A.M...........Lecturer on the Consular Service
William Hamilton, Ph.D.....................Lecturer on History
Charles H. Duell, A.B., LL.B....Lecturer on Substantive Patent Law
Noble P. Barnes, M.D...................Lecturer on Materia Medica

Library Staff.

Arts and Sciences.

Harriet Freebey, LL.M.....................................Librarian

Medicine.

C. B. Conklin...Librarian
A. S. Boarman..................................Assistant Librarian

Law and Jurisprudence, Politics and Diplomacy.

Milo B. Goodall..................................Assistant Librarian
Leroy A. McGee..................................Assistant Librarian

ORGANIZATION.

The George Washington University comprehends the following Departments:

DEPARTMENT OF ARTS AND SCIENCES, including
- Faculty of Graduate Studies.
- Columbian College.
- Washington College of Engineering.
- Division of Architecture.

DEPARTMENT OF MEDICINE:
- Faculty of Medicine.
- Faculty of Dentistry.
- National College of Pharmacy.

DEPARTMENT OF LAW AND JURISPRUDENCE.

DEPARTMENT OF POLITICS AND DIPLOMACY.

THE UNIVERSITY ASSEMBLY.

The University Assembly meets regularly on Wednesdays throughout the session at 12 o'clock. Members of the faculties and students of all departments are expected to be present. The exercises are regularly presided over by the President. Religious services are held, official announcements are made, and an address is given by the President.

THE UNIVERSITY LIBRARY.

The University Library comprehends (1) the Library of the Department of Arts and Sciences, (2) the Law Library, and (3) the Medical Library. It is in charge of the Library Committee, composed of professors in the various departments who administer the expenditure of the annual appropriation for the purchase of new books and look after the general interests of the Library. Details are given under the sections of the Catalogue devoted to the several departments. The Germanic Library of the late Professor Richard Heinzel, of the University of Vienna, recently acquired by the University, contains 7,200 volumes and pamphlets bearing on Germanic philology and literature, and a large number of works and periodicals in the cognate branches, especially Anglo-Saxon, Old English, the Romance and Slavic languages.

The Library of Congress is steadily perfecting its collections of standard works in the various branches of university study, and advanced and graduate students are there given every facility for pursuing their investigations.

ANNUAL COMMENCEMENT AND WINTER CONVOCATION.

The Annual Commencement is held on the first Wednesday in June. The Winter Convocation is held on the 22d of February. Degrees are publicly conferred on Commencement Day and at the Winter Convocation. Members of the faculties and candidates for degrees are expected to appear in academic caps and gowns. Prizes for special excellence in any department are publicly delivered on Commencement Day.

PRIVILEGES IN GOVERNMENTAL INSTITUTIONS OPEN TO UNIVERSITY STUDENTS.

In order to promote research and the diffusion of knowledge, the Congress of the United States has made the scientific resources of the Government accessible to students under the terms of the following joint resolution, approved April 12, 1892:

"*Resolved by the Senate and House of Representatives of the United States of America in Congress assembled,* That the facilities for research and illustration in the following and any other governmental collections now existing or hereafter to be established in the city of Washington for the promotion of knowledge shall be accessible, under such rules and restrictions as the officers in charge of each collection may prescribe, subject to such authority as is now or may hereafter be permitted by law, to the scientific investigators and to students of any institution of higher education now incorporated or hereafter to be incorporated under the laws of Congress or of the District of Columbia, to wit:

1. Of the Library of Congress.
2. Of the National Museum.
3. Of the Patent Office.
4. Of the Bureau of Education.
5. Of the Bureau of Ethnology.
6. Of the Army Medical Museum.
7. Of the Department of Agriculture.
8. Of the Fish Commission.
9. Of the Botanic Gardens.
10. Of the Coast and Geodetic Survey.
11. Of the Geological Survey.
12. Of the Naval Observatory."

Libraries.—In the archives of the State and other Departments and in the statistical bureaus of these Departments are extensive

accumulations of original historical documents and data which are invaluable to graduate students in history, political science, economics, sociology, and the allied topics of research. The Library of Congress, the Public Library of the District of Columbia, and the many highly specialized libraries attached to the various Departments of the Government are made easily accessible. Herbert Putnam, LL.D., Librarian of Congress, has said of them:

"There are thus in the city of Washington THIRTY-FOUR governmental libraries freely available for research. These libraries now contain in the aggregate over two million books and pamphlets and over a half million other articles literary in character—manuscripts, maps, music, and prints. If we add to them the contents of the District Library and of the libraries of private associations and institutions * * * we shall have a total not merely greater than is to be found in any other city of this size in the world, but one which in proportion to population represents several times as many volumes per capita as exist for public use in ANY other city of the world. * * * Today the Library of Congress is a collection, including duplicates, of over 1,100,000 books and pamphlets and nearly half a million other articles. It is housed in a building devoted to its sole use—the largest library building in the world, the most commodious, the most efficient in equipment for the work which it has to do; a building which provides for ample classification and display of the material, for reasonable growth, and for a multitude and great variety of service; a building which may accommodate a thousand readers at a time and differentiate them to their best advantage."

Museums.—In the collections of the National Museum, the Smithsonian Institution, the Army Medical Museum, the Museum of Naval Hygiene, and the departmental museums are found extensive series of specimens of great value to the student of anthropology, archæology, mineralogy, geology, paleontology, biology in all its branches, and other sciences. In the Patent Office are the records of the many inventions that have contributed so materially during our national existence to modify the conditions under which we live. The Army Medical Museum, which is open for inspection daily, presents a field for study superior to any other institution of the kind, either in this country or in Europe. Its library of medical books and periodicals is the best in the world. It has an unrivaled collection of anatomical and pathological specimens, illustrating normal anatomy and the results of disease in every form, and an almost unlimited number of other preparations showing the effect of gunshot wounds and surgical injuries of every kind. It also contains almost numberless crania of every human nationality.

In the National Museum is found the most complete and best arranged collection of Materia Medica in the world. The drugs are shown in all their processes of manufacture, from the original package to the delicate alkaloid constituting the active principle.

Laboratories.—In the experimental sciences the most notable facilities are available, since in Washington are centered the Weather Bureau, with its appliances for the study of national problems in meteorology; the Coast and Geodetic Survey, from which the surveys of our territory are carried on and by which the figure of the earth and terrestrial magnetism are experimentally determined; the Hydrographic Bureau, which conducts the surveys of foreign coasts and the study of the oceans; the Bureau of Standards, which standardizes the instruments used in measuring mass, volume, heat, light, electricity, and all other magnitudes; the Geological Survey, which investigates the structure of the earth, ascertains our mineral resources, and supervises the sources of supply and means for distribution and control of water for irrigation purposes; the Department of Agriculture, which exists primarily for conducting original investigations for the benefit of agriculture in all its branches, and is therefore provided with extensively equipped laboratories for the study of chemistry, botany, vegetable physiology, entomology, bio-chemistry, bacteriology, comparative pathology, parasitology, the physics and chemistry of the soil, forestry, and microscopy; the Naval Observatory and Nautical Almanac Office, where researches in astronomy and navigation are conducted; the Marine Hospital Service, which deals with national problems in hygiene; the Bureaus of Construction and of Steam Engineering of the Navy, having supervision over the designs and construction of our ships; the Bureau of Yards and Docks, having supervision over the engineering operations at our navy yards and naval stations; the Bureau of Equipment, which is charged with the electrical installations for the Navy; the United States Signal Corps, which has supervision over the electrical installations for the Army; the Engineer Corps of the Army, which is charged with river and harbor improvements, and the Light-House Board, which controls the system for lighting our navigable waters.

Of chemical laboratories for conducting the tests of materials, and especially for research work, there are now eighteen attached to the different departments at Washington. An extensive new laboratory is being equipped for the Marine Hospital and Public Health Service. This is the national health department of the Government. In this laboratory and in the laboratories of the Department of Agriculture there are superior facilities for all kinds

of bacteriological and chemical investigations, and for the study of bio-chemistry, comparative pathology, and parasitology. The new laboratories and hospitals of the Army and the Navy also offer many opportunities for instruction.

Washington offers exceptional opportunities for special or advanced work in Mechanical Engineering. The departments of the Government charged with designing are all located here. In the Bureaus of Steam Engineering and of Construction and Repair, and Ordnance, of the Navy, are projected a large amount and extensive variety of heavy constructional work. Here is also located the United States Navy or Ordnance Gun Factory. The Ordnance Proving Station is but a few miles down the Potomac. Tours of inspection may be made to the large steel works and shipbuilding plants in Baltimore, and to the shipbuilding plant at Newport News.

PART II.

DEPARTMENTS OF THE UNIVERSITY.

DEPARTMENT OF ARTS AND SCIENCES.

The Department of Arts and Sciences comprehends the following:

I. FACULTY OF GRADUATE STUDIES.

II. COLUMBIAN COLLEGE.

III. WASHINGTON COLLEGE OF ENGINEERING.

IV. DIVISION OF ARCHITECTURE.

This Department is open to young men and young women who satisfy its requirements. The session of 1906-1907 begins Wednesday, September 26, 1906. The main building of the University, in which most of the courses of study are conducted, is University Hall, corner Fifteenth and H streets, N. W. The offices of the President, Assistant Treasurer, and Registrar of the University are in this building.

I. FACULTY OF GRADUATE STUDIES.

COMMITTEE ON HIGHER DEGREES.

CHARLES E. MUNROE, *Chairman*.
J. MACBRIDE STERRETT.
HERMANN SCHOENFELD.

FACULTY.

CHARLES WILLIS NEEDHAM, LL.D.,........PRESIDENT OF THE UNIVERSITY
CHARLES E. MUNROE, Ph.D..........Dean, and Professor of Chemistry
JAMES HOWARD GORE, Ph.D..................Professor of Mathematics
HOWARD LINCOLN HODGKINS, Ph.D....................Professor of Physics
JAMES MACBRIDE STERRETT, D.D..................Professor of Philosophy
HERMANN SCHOENFELD, Ph.D.......................Professor of German
CHARLES CLINTON SWISHER, Ph.D., LL.D.............Professor of History
WILLIAM ALLEN WILBUR, A.M........................Professor of English
MITCHELL CARROLL, Ph.D................Professor of Classical Philology
GEORGE N. HENNING, A.M..............Professor of Romance Languages
THEODORE N. GILL, Ph.D..........................Professor of Zoölogy
CLEVELAND ABBE, LL.D.........................Professor of Meteorology
EDGAR FRISBY, A.M...........................Professor of Astronomy
FRANK W. CLARKE, Sc.D...................Professor of Mineral Chemistry

Harvey W. Wiley, Ph.D. .... Professor of Agricultural Chemistry
Frank H. Bigelow, L.H.D. .... Professor of Astro-Physics
George P. Merrill, Ph.D. .... Professor of Geology and Mineralogy
Frank A. Wolff, Ph.D. .... Professor of Electrical Engineering
Herbert L. Rice, M.S. .... Professor of Astronomy
Henry A. Pressey, Ph.D. .... Professor of Civil Engineering
Paul Bartsch, M.S., Ph.D. .... Professor of Zoölogy
Frank Van Vleck, Ph.D. .... Professor of Mechanical Engineering
Percy Ash, C.E. .... Professor of Architecture
C. W. A. Veditz, Ph.D. .... Professor of Economics
George Lansing Raymond, L.H.D. .... Professor of Æsthetics
Henry L. Abbott, Brig. Gen. U. S. A., LL.D. .... Professor of Hydraulic Engineering
George M. Sternberg, Surgeon Gen., U. S. A. .... Professor of Preventive Medicine
Edward B. Rosa, Ph.D. .... Professor of Physics
N. Monroe Hopkins, Ph.D. .... Assistant Professor of Chemistry
Albert Mann, A.M., Ph.D. .... Professor of Botany
Charles Sidney Smith, A.M. . Assistant Professor of Greek and Latin
Edwin A. Hill, Ph.D. .... Assistant Professor of Stereo-Chemistry
Thomas M. Price, Ph.D. .... Assistant Professor of Biochemistry
Philander Betts, M.S., E.E. .... Assistant Professor of Electrical Engineering
Timothy W. Stanton, Ph.D. ...... Assistant Professor of Paleontology
Otis T. Mason, LL.D. .... Lecturer on Anthropology
William T. Harris, LL.D. .... Lecturer on Philosophy
Edgar Buckingham, Ph.D. .... Lecturer on Thermodynamics
Frederick E. Fowle, Jr., S.B. .... Lecturer on Astrophysics
Otis D. Swett, B.S. .... Secretary

The Division of Graduate Studies is charged with the development and supervision of research courses leading to the higher degrees. This work was organized at this University in 1893 with a view to enable properly equipped students to avail themselves of the advantages which Washington offers for original investigations. Announcements relative to the official matters of this Division are made at the University Assembly, and professors and students of this Division are expected to be governed by them.

HIGHER DEGREES.

The higher degrees conferred in course by the University in this division of the Department of Arts and Sciences are Master of Arts (A.M.), Master of Science (M.S.), Civil Engineer (C.E.), Electrical Engineer (E.E.), Mechanical Engineer (M.E.), and Doctor of Philosophy (Ph.D.).

ADMISSION.

Candidates for admission to courses for higher degrees must present the diplomas they hold, or certificates that they have received such diplomas, to the Registrar of the University, and obtain from him application blanks. When properly filled and signed, these applications are to be submitted to the Chairman of the Committee on Higher Degrees, together with catalogues of the institutions from which they hold their degrees and certificates of their course of study at such institutions. All such applications should be accompanied by testimonials as to character and scholarship.

DEGREES OF MASTER OF ARTS AND MASTER OF SCIENCE.

Before a student can be admitted to candidacy for the Master's degree he must give evidence that he has completed a liberal undergraduate course of academic study such as is required by colleges of good standing antecedent to the baccalaureate degree. The President's Council reserves the right to decide in all cases whether the antecedent training fulfils the requirements. Moreover, the courses of study pursued for this degree must be approved by the University Council as qualifying the candidate for pursuing the chosen line of study for the Master's degree.

A candidate for this degree shall pass at least one full year of residence and study at this University, and shall sustain satisfactory examinations on the studies pursued and present an acceptable thesis, together with a bibliography.

Three full courses throughout the year shall be the minimum required as constituting a full year's work. The courses chosen must be passed upon by the President's Council and have the approval of the professors under whom they are to be taken. These courses may consist of special study or research work. In any case they must form a consistent plan of work, for which the candidate's previous work has qualified him. No work done for a Bachelor's degree shall be counted again for a Master's degree. Theses in their final form must be presented to the Chairman not later than May 1 for graduation in June, or January 1 for graduation at the Winter Convocation.

HIGHER DEGREES IN ENGINEERING.

Before a student can be admitted to candidacy for higher degrees in Engineering he must give evidence that he has completed a liberal undergraduate course of academic study such as is required by colleges of good standing antecedent to the baccalaureate degree

in Engineering, and which was of such a character as to fit him to pursue to advantage the study of advanced engineering topics. The President's Council reserves the right to decide in all cases whether the antecedent training fulfils the requirements. Moreover, the courses of study pursued for the Bachelor's degree must be approved by the University Council as qualifying the candidate for pursuing the chosen line of study for the degree.

A candidate for a degree in Engineering shall pass at least one full year of residence and study at this University, and shall sustain satisfactory examinations on the studies pursued and present an acceptable thesis, together with a bibliography.

Three full courses will be the minimum required as constituting a full year's work. At least one-half of this work must be in the course in which the degree is sought and the balance in correlated courses. The courses chosen must be passed upon by the President's Council and have the approval of the professors under whom they are to be taken. Theses in their final form must be presented to the Chairman not later than May 1 for graduation in June or January 1, for graduation at the Winter Convocation.

DEGREE OF DOCTOR OF PHILOSOPHY.

The degree of Doctor of Philosophy is conferred upon students who have pursued specialized courses in university subjects and engaged in original research in certain of the various departments of letters or science, under university auspices, for a period of not less than three years, and have submitted an acceptable thesis and met all the requirements prescribed. The degree is given, not because of the faithful completion of a course of study according to a stated program for a given length of time, but for high attainments and proved ability to do research work in some special branch of knowledge, as determined by the various tests applied.

Before a student can be admitted to candidacy for the degree of Doctor of Philosophy he must give evidence that he has completed a liberal undergraduate course of academic study such as is required by colleges of good standing antecedent to the baccalaureate degree, and which was of such a character as to fit him to pursue to advantage researches in the field chosen for graduate work. The President's Council reserves the right to decide in all cases whether the antecedent training fulfils the requirements. The applicant may be credited with graduate work done at other universities, provided such work is shown to be of grade similar to that required here, but at least one year must be spent in residence at this University and the other requirements of the degree as prescribed must be fulfilled.

Candidates for the degree of Doctor of Philosophy shall offer themselves in three topics from the university subjects—one major and two collateral minor studies—the combination to be approved by the President's Council. These must be pursued under the guidance of a committee, consisting of the professors in charge of the departments in which studies are pursued, with the professor in the major subject as Chairman. This committee will determine his division of time, study, and research among the major and minor topics, but in general the major topic should be pursued during the whole time devoted to graduate work, and each minor topic during at least one year. The candidate shall pass satisfactory written examinations upon the three subjects selected. The examinations in the minor topics may be taken at the completion of the courses pursued or at the discretion of the professor in charge. In written examinations the time limit is four hours for the major and three hours for the minor topics. The candidate must show that he possesses a reading knowledge of French and German, as evinced by familiarity with philological or scientific monographs pertaining to his special branches of study. The head professor of a subject may require such knowledge of other subjects as is considered fundamental. The candidate must present a satisfactory thesis, together with an exhaustive bibliography, exhibiting independent research in some branch of his major subject, under the following regulations:

REGULATIONS REGARDING THESES.

Theses must be presented not later than May 1 for graduation in June, or January 1 for graduation at the Winter Convocation.

After their acceptance, theses, with their accompanying drawings, are the property of the University, and must be deposited in the University archives, but authors are permitted to make copies. All theses must be typewritten on official thesis paper, which may be obtained from the Assistant Treasurer of the University. No thesis for the degree of Doctor of Philosophy shall be submitted to the University Council until it has been approved by the professor having supervision of the major topic, and also by a co-referee to be appointed by the President's Council. The referees shall present to the Council written reports on the thesis to be filed therewith. The candidate is expected to print his thesis, under the supervision of the professor in charge of his major topic, within one year after the degree is granted, and shall present one hundred copies to the University, to be distributed among institutions of learning. The candidate must defend his thesis before a board of experts consisting of three specialists of university standing and established reputation in the subject represented by the principal topic, to be appointed by the President's Council.

Typical Title Page for a Thesis in the Division of Graduate Studies.

A COMPARATIVE STUDY

OF THE

LOWER CRETACEOUS FORMATIONS AND FAUNAS

OF THE

UNITED STATES.

A Thesis Submitted to the Faculty of Graduate Studies of The George Washington University in Part Satisfaction of the Requirements for the Degree of Doctor of Philosophy.

BY

TIMOTHY WILLIAM STANTON, B.S., M.S.

Washington, D. C.

1897.

DOCTORATE DISPUTATION.

A Doctorate Disputation was held publicly in University Hall, May 22, 1905. The theses that were successfully defended, the candidates, and the members of the boards of experts were as follows:

Thesis: A study of the James Types of Ordovician and Silurian Bryozoa.

By Ray Smith Bassler, B.A., 1902, University of Cincinnati; M.S., 1903, The Columbian University.

Before David White, B.S., Geologist, U. S. Geological Survey; George H. Girty, Ph.D., Stratigraphic Paleontologist, U. S. Geological Survey; Edward O. Ulrich, Sc. D., Geologist, U. S. Geological Survey; Professor George P. Merrill, Ph.D., presiding.

Thesis: On the Constitution of Certain Natural Silicates.

By Hiram Colver McNeil, B.S., 1896; M.S., 1899, Denison University.

Before William A. Noyes, Ph.D., Chief Chemist, National Bureau of Standards; Henry N. Stokes, Ph. D., Chemist, National Bureau of Standards; Allerton S. Cushman, Ph.D., Chemist in Charge, Division of Tests, U. S. Department of Agriculture; Professor F. W. Clarke, Sc. D., presiding.

Thesis: Flow of Water in Channels.

By Henry Albert Pressey, B.S., 1893, The Columbian University; B.S., 1896, Massachusetts Institute of Technology.

Before Lieutenant Colonel Smith S. Leach, Engineer Corps, U. S. Army; Elwood Mead, C.E., Irrigation Expert, U. S. Department of

Agriculture; Homer P. Ritter, Member Mississippi River Commission; Brigadier General Henry L. Abbot, Engineer Corps, U. S. Army, presiding.

TOPICS FOR STUDY.

The topics and courses from which elections may be made are announced in the second and third sections of University Subjects, Department of Arts and Sciences, and in the similar sections of the curricula of the Departments of Medicine, Law and Jurisprudence, and Politics and Diplomacy. In filling out application blanks the number of the course must be given.

II. COLUMBIAN COLLEGE.

FACULTY.

Charles Willis Needham, LL.D.........President of the University
William Allen Wilbur, A.M..........Dean and Professor of English
James Howard Gore, Ph.D..................Professor of Mathematics
Howard Lincoln Hodgkins, Ph.D................Professor of Physics
James Macbride Sterrett, A.M., D.D.........Professor of Philosophy
Charles E. Munroe, Ph.D...................Professor of Chemistry
Hermann Schoenfeld, Ph.D., LL.D..............Professor of German
Charles Clinton Swisher, Ph.D., LL.D.........Professor of History
Mitchell Carroll, Ph.D..............Professor of Classical Philology
George N. Henning, A.M............Professor of Romance Languages
Percy Ash, C.E...........................Professor of Architecture
C. William A. Veditz, Ph.D., LL.B...........Professor of Economics
Williston S. Hough, Ph.M...................Professor of Philosophy
Frank Leighton Day, Ph.D.......Professor of Semitic Languages and Literature
George P. Merrill, Ph.D.........Professor of Geology and Mineralogy
Paul Bartsch, Ph.D...........................Professor of Zoölogy
George Lansing Raymond, L.H.D..............Professor of Æsthetics
Henry Parker Willis, Ph.D....................Professor of Finance
Albert Mann, Ph.D...........................Professor of Botany
Edward Adams Muir, B.S.............Assistant Professor of Graphics
Charles Sidney Smith, A.M...Assistant Professor of Greek and Latin
N. Monroe Hopkins, Ph.D...........Assistant Professor of Chemistry
Edwin A. Hill, Ph.D................Assistant Professor of Chemistry
Thomas Malcolm Price, Ph.D.......Assistant Professor of Chemistry
William Hamilton, Ph.D.......................Lecturer on History
Oscar Quick, A.M.............................Instructor in Physics
F. L. Molby.......................Instructor in Freehand Drawing
Levi Russell Alden, A.M.....................Instructor in History
Isaac Allison, E.E..........................Instructor in Graphics
R. S. Bassler, Ph.D.........................Instructor in Geology
Otis D. Swett, B.S............Instructor in Chemistry and Secretary
Paul Noble Peck, A.M....................Instructor in Mathematics
De Witt C. Croissant, A.B...................Instructor in English
Oscar L. Keith, A.M...............Instructor in Romance Languages
Ashton Waugh McWhorter, Ph.D.....Instructor in Greek and Latin
Alfred F. W. Schmidt, A.M...................Instructor in German
Edwin Vivian Dunstan, B.S..........Instructor in Civil Engineering
Edward M. Dawson, Jr., B.S..................Instructor in History
Asaph Hall, Ph.D.........................Instructor in Mathematics

RAYMOND OUTWATER, M.S. .... Assistant in Assaying
EDWIN SMITH, JR. .... Assistant in Chemistry
OTTO LOUIS VEERHOFF, A.B. .... Assistant in German

STANDING COMMITTEES OF THE FACULTY.

Committee on the Bachelor of Arts Course.

Professors GORE, SWISHER, CARROLL.

Committee on the Bachelor of Science Course.

Professors HODGKINS, HENNING, MERRILL.

Committee on the Schedule.

Professors HENNING, GORE, HODGKINS.

The session of 1906-1907 begins Wednesday, September 26, 1906.

Columbian College is open to young men and young women. The courses of study in this department are mainly conducted in University Hall, corner Fifteenth and H streets, N. W. The office of the Dean of the College is in this building.

ADMISSION.

Every applicant for admission is required to present a testimonial of good character, and also a certificate of standing and regular dismissal from the school or college which he has attended or from the tutor with whom he has studied.

Candidates for admission to the Freshman Class may present certificates of admission or take an examination in the required subjects. Certificates, in lieu of any or all examinations, will be accepted from schools whose work is attested by well-prepared students admitted to the University in previous years, and from schools desiring coöperation with the University, that present evidence of affording adequate preparation in the required subjects. The Registrar of the University will, on application, furnish certificate blanks to the principals of such accredited schools.

The certificate of the College Entrance Examination Board will be accepted in so far as the subjects specified meet the requirements for admission.

The certificate of the Washington high schools covering all the requirements for admission admits students without examination to the courses of the Freshman year.

The certificates of all schools accredited to the University will be accepted in so far as they specifically meet the requirements for admission.

The general requirement for admission is a four-year high school course, or its equivalent, consisting usually of four or five recitations per week in four or more topics. The High School studies which may be presented in satisfaction of the requirements of admission are given in the adjoining table, the unit being four or five recitations per week for one school year. The figures show the relative value of each subject. The list is substantially that set forth in Document No. 25 of the College Entrance Examination Board.

LIST OF PREPARATORY SUBJECTS FOR EXAMINATION.

Subject	Units.
English	4
Latin:	
Elementary	2
Advanced	2
Greek:	
Elementary	2
Advanced	1
French:	
Elementary	2
Advanced	2
Spanish	2
German:	
Elementary	2
Advanced	2
History:	
Ancient	1
Mediæval and Modern	1
History:	
English	1
American and Civil Government	1
Mathematics:	
Elementary Algebra	1
Advanced Algebra	½
Plane Geometry	1
Solid Geometry	½
Plane Trigonometry	½
Physics	1
Chemistry	1
Botany	1
Zoölogy	1
Physiography	1
Drawing	1
Shopwork	2

TERMS OF ADMISSION TO BACHELOR OF ARTS COURSES.

Candidates for admission to the course leading to the degree of Bachelor of Arts are required to present subjects from the list of High School studies aggregating fifteen units, distributed as follows:

Subject	Units.
English	4
Latin	4
Greek *or* French or German	3 *or* 2
Elementary Algebra	1
Plane Geometry	1
Electives	2 or 3
	15

TERMS OF ADMISSION TO BACHELOR OF SCIENCE COURSES.

Candidates for admission to the courses leading to the degree of Bachelor of Science are required to present subjects from the list of High School studies aggregating fifteen units, distributed as follows:

	Units.
English	4
French or German	2
Elementary Algebra	1
Plane Geometry	1
Physics	1
Chemistry	1
Electives	5
	15

EXAMINATIONS FOR ADMISSION.

The regular examination for admission to the Freshman Class is held in University Hall, southeast corner of Fifteenth and H streets, N. W., during the week preceding the Commencement. The following is the schedule for the examination:

May 28, 1906.

Registration of Applicants at the Dean's office	8.30- 9.00
Latin; Drawing	9.00-11.00
Plane Geometry	11.00- 1.00
Elementary Algebra	2.00- 4.00

May 29.

Greek; Physics	9.00-11.00
Ancient History	11.00- 1.00
German	2.00- 4.00
French	4.00- 6.00

May 31.

Plane Trigonometry; Botany	9.00-11.00
English History	11.00- 1.00
English	2.00- 4.00

June 1.

Advanced Algebra; Zoölogy	9.00-11.00
Solid Geometry; Spanish	11.00- 1.00
Chemistry; Physiography	2.00- 4.00

Subjects offered for admission, but not named in the schedule of examinations, will be arranged for as occasion arises.

Unless admitted by certificate, every undergraduate candidate for a degree is required to pass an examination.

DEFINITION OF REQUIREMENTS.

ENGLISH.

(Counting four units.)

The requirement in English is that recommended by the Conference on Uniform Entrance Requirements in English.

NOTE—No candidate will be accepted in English whose work is notably defective in point of spelling, punctuation, idiom, or division into paragraphs.

a. READING. The form of examination will usually be the writing of a paragraph or two on each of several topics to be chosen by the candidate from a considerable number—perhaps ten or fifteen—given in the examination paper. The treatment of these topics is designed to test the candidate's power of clear and accurate expression, and will call for only a general knowledge of the substance of the books. *In every case knowledge of the book will be regarded as less important than the ability to write good English.* In preparation for this part of the examination, it is important that the candidate shall have been instructed in the fundamental principles of rhetoric.

Candidates should read the books prescribed for the year in which they propose to present themselves for this part of the examination.

In 1906, 1907, and 1908 the books prescribed for this part of the examination are as follows:

Shakespeare's *The Merchant of Venice* and *Macbeth; The Sir Roger de Coverley Papers* in the Spectator; Irving's *Life of Goldsmith;* Coleridge's *The Ancient Mariner;* Scott's *Ivanhoe* and *The Lady of the Lake;* Tennyson's *Gareth and Lynette, Lancelot and Elaine,* and *The Passing of Arthur;* Lowell's *The Vision of Sir Launfal;* George Eliot's *Silas Marner.*

In 1909, 1910, and 1911 ten books, selected as prescribed below from the following list, are to be offered for examination:

Group I (two to be selected).

Shakespeare's *As You Like It, Henry V, Julius Cæsar, The Merchant of Venice, Twelfth Night.*

Group II (one to be selected).

Bacon's *Essays;* Bunyan's *The Pilgrim's Progress, Part I; The Sir Roger de Coverley Papers* in the Spectator; Franklin's *Autobiography.*

Group III (one to be selected).

Chaucer's *Prologue;* Spenser's *Faerie Queene* (selections); Pope's *The Rape of the Lock;* Goldsmith's *The Deserted Village;* Palgrave's *Golden Treasury (First Series), Books II and III,* with especial attention to Dryden, Collins, Gray, Cowper and Burns.

Group IV (two to be selected).

Goldsmith's *The Vicar of Wakefield;* Scott's *Ivanhoe;* Scott's *Quentin Durward;* Hawthorne's *The House of the Seven Gables;* Thackeray's *Henry Esmond;* Mrs. Gaskell's *Cranford;* Dickens' *A Tale of Two Cities;* George Eliot's *Silas Marner;* Blackmore's *Lorna Doone.*

Group V (two to be selected).

Irving's *Sketch Book;* Lamb's *Essays of Elia;* De Quincey's *Joan of Arc* and *The English Mail Coach;* Carlyle's *Heroes and Hero Worship;* Emerson's *Essays* (selected); Ruskin's *Sesame and Lilies.*

Group VI (two to be selected).

Coleridge's *The Ancient Mariner;* Scott's *The Lady of the Lake;* Byron's *Mazeppa* and *The Prisoner of Chillon;* Palgrave's *Golden Treasury (First Series), Book IV,* with especial attention to Wordsworth, Keats, and Shelley; Macaulay's *Lays of Ancient Rome;* Poe's *Poems;* Lowell's *The Vision of Sir Launfal;* Arnold's *Sohrab and Rustum;* Longfellow's *The Courtship of Miles Standish;* Tennyson's *Gareth and Lynette, Lancelot and Elaine,* and *The Passing of Arthur;* Browning's *Cavalier Tunes, The Lost Leader, How They Brought the Good News from Ghent to Aix, Evelyn Hope, Home Thoughts from Abroad, Home Thoughts from the Sea, Incident of the French Camp, The Boy and the Angel, One Word More, Harvé Riel, Pheidippides.*

b. Study and Practice. This part of the examination presupposes the thorough study of each of the works named below. The examination will be upon subject-matter, form, and structure. In addition, the candidate may be required to answer questions involving the essentials of English grammar, and questions on the leading facts in those periods of English literary history to which the prescribed works belong.

The books set for this part of the examination will be:

1906, 1907, 1908: Shakespeare's *Julius Cæsar;* Milton s *Lycidas, Comus, L'Allegro,* and *Il Penseroso;* Burke's *Speech on Conciliation with America;* Macaulay's *Essay on Addison* and *Life of Johnson.*

1909, 1910, 1911: Shakespeare's *Macbeth;* Milton's *Lycidas, Comus, L'Allegro,* and *Il Penseroso;* Burke's *Speech on Conciliation with America,* or Washington's *Farewell Address* and Webster's *First Bunker Hill Oration;* Macaulay's *Life of Johnson,* or Carlyle's *Essay on Burns.*

LATIN.

The minimum requirements in Latin and Greek are in substantial agreement with those set forth in Document No. 25 of the College Entrance Examination Board, which carry out the recommendations of the Committee of Twelve of the American Philological Association:

The Elementary Requirement (counting two units).

a. i. Latin Grammar: The inflections; the simpler rules for composition and derivation of words; syntax of cases and the verbs; structure of sentences in general, with particular regard to relative and conditional sentences, indirect discourse, and the subjunctive; so much prosody as relates to accent, versification in general, and dactylic hexameter.

ii. Latin Prose Composition: Translation into Latin of detached sentences and easy continuous prose based upon Cæsar.

b. Cæsar: Any four books of the Gallic War, preferably the first four, or their equivalent.

The Advanced Requirement (counting two units).

a. Cicero: Any six orations from the following list, but preferably the first six mentioned:

The four orations against Catiline, Archias, the Manilian Law, Marcellus, Roscius, Milo, Sestius, Ligarius, the Fourteenth Philippic.

b. Vergil: The first six books of the Æneid.

c. Advanced Prose Composition, consisting of continuous prose of moderate difficulty based on Cicero.

d. Sight Translation, based on prose of no greater difficulty than the easier portions of Cicero's orations.

GREEK.

The Elementary Requirement (counting two units).

a. i. Greek Grammar: The topics for the examination in Greek grammar are similar to those detailed under Latin grammar.

ii. Greek Prose Composition, consisting principally of detached sentences to test the candidate's knowledge of grammatical constructions.

The examination in grammar and prose composition will be based on the first two books of Xenophon's Anabasis.

b. Xenophon: The first four books of the Anabasis.

The Advanced Requirement (counting one unit).

a. Homer: The first three books of the Iliad (omitting II, 494, to end).

b. Sight Translation, based on prose of no greater difficulty than Xenophon's Anabasis.

FRENCH.

Elementary (counting two units). Candidates in Elementary French must have a good knowledge of the essential parts of grammar, with stress on pronouns and on regular verbs and the common irregular verbs. They must know the principles of pronunciation; must be able to translate simple English sentences or easy connected prose into French, and to translate accurately ordinary modern French prose. Candidates must have translated not less than 450 duodecimo pages by at least four different authors, of which amount at least one-third must be history. Candidates must have had a two-years' course of at least four periods per week.

Advanced (counting two units). Candidates in Advanced French must have partly translated, partly read, in addition to the requirements for Elementary French, at least 1,000 pages of difficult French of several different authors, including history, fiction, drama, and poetry. Candidates must have had a four-years' course of at least four periods per week.

Fraser and Squair's French Grammar or Grandgent's Essentials of French Grammar is recommended.

SPANISH.

(Counting two units.)

Candidates in Spanish must have a good knowledge of grammar, including syntax, with stress on pronouns and verbs, regular and irregular. They must know the principles of pronunciation. They must be able to translate simple English sentences or easy connected prose into Spanish, and to translate accurately fairly difficult modern Spanish prose and verse. Candidates must have translated not less than 500 pages by at least four different authors, of which amount at least one-fourth must be history or drama. Candidates must have had a two-years' course of at least four periods per week.

GERMAN.

Elementary (counting two units). Candidates in Elementary German must have had a two-years' course of at least four periods a week. They must be able to read fluently at sight and to translate easy

narrative prose and poetry. An accurate knowledge of an elementary German grammar is requisite, to be tested by the translation into German of some fifteen sentences. About 300 pages of graduated narrative prose, one short play, and such poetry as is usually found in a First Reader will be considered an adequate preparation.

Advanced (counting two units). Candidates in Advanced German must have had a four-years' course of at least four periods a week. They should be well trained in the syntactical laws of the language, have read about 800 pages of good literature in prose, preferably such prose works as are given in the Report of the Committee of Twelve of the Modern Language Association, and poetry, especially dramas by Lessing, Schiller, and Goethe, and studied an elementary history of German literature. German composition should comprise a number of short themes upon assigned historical or literary topics, lives of the authors read, etc.

HISTORY.

In this subject special importance is attached to preparation in geography.

Ancient (counting one unit).

(*a*) Greek History, through the Roman Conquest; as much as is contained in Myers' History of Greece.
(*b*) Roman History; as much as is contained in Allen's History of the Roman People.

Mediæval and Modern European History (counting one unit). As much as is contained in Myers' History of Mediæval and Modern Europe.

English History (counting one unit). As much as is contained in Larned's History of England.

American History with the Elements of Civil Government (counting one unit). As much as is contained in Fiske's History of the United States, and Fiske's Civil Government.

MATHEMATICS.

Elementary Algebra (counting one unit).

i. Algebra to Quadratics:

The four fundamental operations for rational algebraic expressions, factoring, highest common factor, lowest common multiple, complex fractions, the solution of equations of the first degree containing one or more unknown quantities, radicals, including the extraction of the square root of polynomials and numbers ,and fractional and negative exponents.

ii. Quadratics, etc.:

Quadratic equations and equations containing one or more unknown quantities that can be solved by the methods of quadratic equations, problems depending upon such equations, ratio and proportion, and the binomial theorem for positive integral exponents.

Advanced Algebra (counting one-half unit).

i. Progressions, etc.:

The progressions, the elementary treatment of permutations and combinations, and the use of four and five place tables and logarithms.

ii. Series, etc.:

Undetermined coefficients, the elementary treatment of infinite series, the binomial theorem for fractional and negative exponents, and the theory of logarithms.

iii. Theory of equations.

Determinants and the elements of the theory of equations, including Horner's method for solving numerical equations.

Plane Geometry (counting one unit).

The solution of simple original exercises and numerical problems.

Solid Geometry (counting one-half unit).

Properties of straight lines and planes, of dihedral and polyhedral angles, of projections, of polyhedrons, including prisms, pyramids, and the regular solids; of cylinders, cones, and spheres, of spherical triangles, and the measurement of surfaces and solids.

Plane Trigonometry (counting one-half unit).

The definitions and relations of the six trigonometrical functions as ratios, proof of important formulæ, theory of logarithms and use of tables, solution of right and oblique plane triangles.

PHYSICS.

(Counting one unit.)

It is recommended that the candidate's preparation should include:

a. Individual laboratory work, comprising at least thirty-five exercises well distributed over the subjects of physics.

b. Instruction by lecture-table demonstrations.

c. The study of at least one standard text-book, supplemented by the use of many and varied numerical problems. The metric system should be familiar to the student.

The laboratory note book must be submitted for inspection, whether the candidate is admitted on certificate or by examination.

CHEMISTRY.

(Counting one unit.)

The candidate's preparation in chemistry should include:

a. Individual laboratory work, comprising at least forty experiments of a character analogous to those set forth in Document No. 25 of the College Entrance Examination Board.

On application for admission to this University, every candidate seeking credit in chemistry must present a note book in which he has recorded the steps and the results of his laboratory exercises. This note book must contain an index to its contents, and must bear an endorsement of the teacher who directed the student, written in ink on the inside of the cover, in the following form:

I certify that this note book is the true and original record of experiments actually performed by ——— in the chemical laboratory of ——— school during the year 19—.

(Signed) —— ——,

Title ——— [*Instructor*] *in Chemistry.*

b. Instruction by lecture-table demonstrations to be used in instructing the student as to methods of manipulation and as a basis for questioning him upon the general principles involved in his laboratory experiments.

c. The study of at least one modern text-book, to the end that the student may gain a comprehensive and connected view of the most important facts and laws of elementary chemistry.

Requirements. The ground to be covered should include the following: The chief physical and chemical characteristics, the isolation and the recognition of the following elements and the preparation and study of their principal compounds: *Oxygen, hydrogen, carbon, nitrogen, chlorine, bromine, iodine, fluorine, sulphur,* phosphorus, silicon, potassium, *sodium,* calcium, magnesium, *zinc,* copper, mercury, silver, aluminum, *lead,* tin, *iron,* manganese, chromium.

The more detailed study should be confined to the italicized *elements* (as such) and to a restricted list of compounds, such as water, hydrochloric acid, carbon monoxide, carbon dioxide, oxides of nitrogen, nitric acid, ammonia, sulphur dioxide, sulphuric acid, hydrogen sulphide, sodium hydroxide, ammonium hydroxide.

Attention should be given to the atmosphere (constitution and relation to animal and vegetable life), flame, acids, bases, salts, oxidation and reduction, crystallization, combining proportions by weight and volume, calculations founded on these and on Boyle's and Charles's laws, symbols, formulas, equations and nomenclature, atomic theory, atomic weights, nascent state, natural groupings of the elements, solution (solvents and solubility of gases, liquids, and solids), strength of acids and bases, conservation and dissipation of energy, chemical energy and electrolysis, and of valence, electrolytic dissociation, osmosis, mass action in a very elementary way. Chemical terms should be clearly understood, and the student should be able to illustrate and apply the ideas that they embody. The theoretical topics are not intended to form separate subjects of study, but to be taught only so far as is necessary for the correlation and explanation of the experimental facts. The facts should be given as examples from various classes and not as isolated things.

BOTANY.

(Counting one unit.)

Candidates must have had at least one year's full work in Botany, comprising the general principles of morphology, physiology, and ecology, as well as the natural history of plant groups and classification. Bergen's Foundations of Botany and Atkinson's Elementary Botany indicate the general scope of the work required.

ZOÖLOGY.

(Counting one unit.)

In general, Zoölogy is not recommended as an entrance subject unless the subject has been preceded or accompanied by that of physics and chemistry, which form the most desirable groundwork for collegiate courses in biology. The entrance examination in zoölogy is designed to test, first, the candidate's practical acquaintance with the natural history, structure, and relationships of some of the leading types of animals, and, second, his knowledge of the more essential facts of physiology.

Practical Zoölogy. A practical examination of at least ten common animal types, and the presentation by the candidate of a laboratory note book, certified by the teacher, as evidence of a laboratory course actually performed. Examples of the types suggested are the frog, fish, mollusk, insects, crustaceans, annelid, starfish, hydroid (hydra), and protozoan. In the examination less weight is laid on

a knowledge of anatomical *minutiae* than on the ability to recognize the specimen and its allies, to indicate its relationship, and to point out the leading features of its life history, organization, and physiology.

Elementary Physiology. The nature of foods and their history in the body; the essential facts of digestion, absorption, circulation, secretion, excretion, and respiration; the motor, nervous, and sensory functions, and the structure of the various organs by which these operations are performed. Martin's *Human Body* (briefer course) forms a suitable basis for this work, but teachers are recommended as far as possible to correlate the physiology of man and the higher animals with that of the lower forms studied in the course of practical zoölogy.

PHYSIOGRAPHY.

(Counting one unit.)

The equivalent of Davis's Physical Geography, together with an approved laboratory and field course of at least forty exercises actually performed by the candidate.

The candidate will be required to present at the time of his examination the original note book in which he recorded, with dates, the steps and results of his laboratory exercises. This book, which should contain an index of subjects, must bear the endorsement of the teacher, certifying that it is a true record of the candidate's work.

DRAWING.

(Counting one unit.)

The candidate's preparation in drawing should include simple geometrical, plane, and solid figures and simple pieces of machinery, with a fair knowledge of the rules of perspective and light and shade as applied in freehand sketching. The candidate should be able to reproduce from a flat copy with enlargement or reduction of size.

For courses in architecture, the preparation should include, in addition to the above, the drawing of simple pieces of architectural ornament (a Greek anthemium, a design of iron scrollwork, etc.).

For courses in engineering, the preparation should include the copying of machinery details.

For courses in general science or in science for teachers, the preparation should include the copying of still life and simple plant forms.

SHOPWORK.

Candidates who have been trained in manual-training schools or in commercial shops in the use of tools and in the ordinary processes employed in the working of wood or metal may receive admission credits for such work. They should submit letters from their teachers or employers, stating the character of the work in which they have been trained and the time given to it. The amount of credit will vary according to circumstances, but it will not exceed two units.

ADMISSION TO ADVANCED STANDING.

Candidates for admission to advanced classes in any department are examined in all indispensable preliminary studies.

Due credit is given for properly certified courses of study pursued in other colleges and universities.

ADMISSION TO SPECIAL COURSES.

All the courses of instruction are open to students of suitable age and attainments who wish, without reference to any degree, to pursue special studies. Candidates are examined in each special study. They must be familiar with the subjects preliminary to the studies which they wish to pursue.

AUDITORS.

Certain courses are open to the public on payment of an auditor's fee. Auditors are without responsibility for class exercises or examinations, and they will receive no credit on the records.

REQUIREMENTS FOR DEGREES.

The undergraduate degrees offered by Columbian College are Bachelor of Arts and Bachelor of Science. To be recommended for either of these degrees, the student must be registered for at least one academic year, must satisfy the admission rquirements, and must complete at least sixty hours of undergraduate courses with the requisite grades.

The studies to be taken by a student during his college course, while largely elective, should be chosen with careful attention to their relation to each other and to his aims and purposes for the future. In general, the courses to be taken during the early years are those given under the first section in University Subjects, while

courses under the second section are elected during the latter part of the course. No time limit is prescribed, and the degree is given when the total of prescribed and elective courses is completed.

BACHELOR OF ARTS COURSE.

To be recommended for the degree of Bachelor of Arts, the student must complete courses of study aggregating at least sixty units. The unit of credit is one hour of recitation or lecture work per week for one academic year. Laboratory hours in Chemistry and in Architecture count one-third unit each, in other subjects one-half unit each. Fifteen of these units are prescribed studies and forty-five are electives. The prescribed studies are the following:

	Units.
English, 1 or 2	3
Mathematics, 3, 5, 7	3
Latin or Greek, 1	3
French or German	3
Philosophy, 1	3

BACHELOR OF SCIENCE COURSES.

General Course for the Degree of Bachelor of Science.

To be recommended for the degree of Bachelor of Science, the student must complete courses of study aggregating at least sixty units. The unit of credit is one hour of recitation or lecture work per week for one academic year. Laboratory hours in Chemistry and in Architecture count one-third unit, in other subjects one-half unit each.

Fifteen of these units are prescribed studies and forty-five are electives. The prescribed studies are the following:

	Units.
English, 1 or 2	3
Mathematics	3
French or German	3
Sciences	6

For the Degree of Bachelor of Science in Chemistry.

Freshman Year.

	Units.		Units.
Chemistry, 1, 2	5	Mathematics, 3, 5, 7	3
General Chemistry		Solid Geometry; Algebra	
Laboratory Practice		Plane Trigonometry	
English, 1	3	French or German	3
Rhetoric		Graphics, 1	2
		Mechanical Drawing	

Sophomore Year.

Chemistry, 3, 20	5	Physics, 1, 2	5
Chemical Preparations		General Physics	
Qualitative Analysis		Physical Laboratory	
French or German	3		
Mathemâtics, 9, 11	3		
Analytic Geometry			
Spherical Trigonometry			

Junior Year.

Architecture, 1	1	French or German	3
Freehand Drawing		Graphics, 2	2
Chemistry, 4, 21, 23	6	Advanced Mechanical Drawing	
Assaying		Geology, 1	2
Quantitative Analysis		Mineralogy	
Organic Chemistry			

Senior Year.

Chemistry, 6, 24, 25, 26, 27	11	Economics or History	2
Metallurgy; Organic Chemistry, lectures and laboratory		Geology, 2	2
Physical Chemistry, Stereo-Chemistry		Geology	

For the Degree of Bachelor of Science in Politics.

This is a course requiring for admission the subjects for the regular Bachelor of Science course, and for graduation sixty units of credit with required subjects limited to English, Modern Languages, History, and the Political Sciences. The course is designed primarily to lead to the graduate work of the Department of Politics and Diplomacy. On the completion of forty-five units of credit in the College the first year's work of the course for Master of Diplomacy may be taken, crediting fifteen units in the College and completing the course for the degree of Bachelor of Science in Politics.

This College course for Bachelor of Science in Politics is correlated in a similar way with the Department of Law.

The course is designed also to minister to the increasing interest in political studies and in higher commercial education. The prescribed studies are the following:

	Units.
English, 1 or 2	3
Modern Languages (including French)	9
History (including American, English, and Modern European History)	9
Economics, Finance, and Political Science	12

UNDERGRADUATE AND PROFESSIONAL COURSES.

Undergraduate students upon the completion of forty-five units of credit may take the first year's work of the course for Doctor of Medicine, Bachelor of Laws, or Master of Diplomacy, crediting them fifteen units in the College, on the completion of which they may receive the Bachelor's degree.

PRIZES.

Only candidates for degrees may compete for these prizes.

STAUGHTON AND ELTON PRIZES.—The Staughton Prize, for excellence in the Latin Language and Literature, and the Elton Prize, for excellence in the Greek Language and Literature, founded by the Rev. Romeo Elton, D.D., of Exeter, England, consist of two gold medals, annually awarded to the best scholar in each of these languages.

RUGGLES PRIZES.—The Ruggles Prizes, for excellence in Mathematics, founded by Professor William Ruggles, LL.D., consist of two gold medals, annually awarded upon examination to the best two scholars in Mathematics.

MUNROE PRIZE.—Professor Munroe offers a gold medal to that student from any Washington high school or the Manual Training School who shall attain the highest mark in Chemistry among those passing the entrance examinations, and shall remain in regular attendance for one year.

CLASS OF '96 JAMES MACBRIDE STERRETT, JR., MEMORIAL MEDAL.—This prize is annually awarded to that student taking Course 1 in Physics who obtains the highest average in a special examination on a given subject and in the writing of an essay on an assigned topic.

DAVIS PRIZES.—The Davis Prizes, for excellence in Elocution, founded by the Hon. Isaac Davis, LL.D., of Massachusetts, consist of three gold medals, annually awarded to the successful competitors in a public contest. Members of the Senior Class are eligible to compete for these prizes.

DAUGHTERS OF THE AMERICAN REVOLUTION PRIZES.—These prizes, founded by the Daughters of the American Revolution of the District of Columbia, consist of two gold medals, awarded annually to the two students in the graduating class who, having maintained a high standing in the regular courses in Mediæval, Modern, European, English, and American History during three years, shall produce the best essays upon an assigned topic of American history.

THOMAS F. WALSH PRIZE IN IRISH HISTORY.—This prize is a gold medal, awarded to that student in the graduating class who, having maintained a high standard in the regular courses of Mediæval, Modern, European, American, and English History, shall produce the best essay based upon the study of some period of Irish history.

E. K. CUTTER PRIZE.—The E. K. Cutter Prize in English was founded by the late Marion Kendall Cutter. The endowment is a fund of one thousand dollars, the income of which is given annually as a prize "for excellence in the study of English." The prize will be awarded to that member of the graduating class whose record in English, combined with general excellence, shows most marked aptitude and attainment in English studies.

WILLIE E. FITCH PRIZE.—The Willie E. Fitch Prize, for highest excellence in all branches of Chemistry, founded by James E. Fitch, Esq., in memory of his son, consists of fifty dollars, which is awarded annually for the best examination in Chemistry.

PRIZE AWARDS, 1904-05.

Staughton Prize	Augusta Moulton De Forest
Elton Prize	Maud Esther McPherson
Ruggles Prize	Edwin Vivian Dunstan
Class of '96 James Macbride Sterrett, Jr., Memorial Medal	Warren Seymour Orton
Davis Prizes	First Prize: Otto Louis Veerhoff
	Second Prize: Amy Louise Warn
	Third Prize: George Foster Harley
Daughters of the American Revolution Prizes	Amy Louise Warn
	Augusta Moulton De Forest
Thomas F. Walsh Prize	Augusta Moulton De Forest
E. K. Cutter Prize	Maud Esther McPherson
Schmidt Prize	Elton W. Miller
Muth Prize	John Hanson Boyden

SCHOLARSHIPS.

Applications for scholarships should be filed with the Dean not later than September fifteenth. All scholarships except the Kendall Scholarship and the University Scholarships are awarded for one year only ,but they may be renewed. Any student holding a scholarship who fails to obtain a general average of 85 per cent on the work of any term or whose deportment is unsatisfactory will be reported to the President's Council, and in the absence of extenuating circumstances the scholarship will be revoked.

KENDALL SCHOLARSHIP.—The Kendall Scholarship, founded by the late Hon. Amos Kendall, is annually conferred on that student from any of the Washington High Schools or from the Manual Training School who attains the highest average in the May entrance examinations. This scholarship continues throughout the undergraduate course, and the student holding it pays only the matriculation, library, laboratory, and graduation fees.

UNIVERSITY SCHOLARSHIPS.—The University offers also six scholarships, each continuing throughout the undergraduate course, to be awarded annually to members of the graduating classes of the high schools of Washington and of the Manual Training School. The scholarships will be divided among the several schools in proportion to the number of students in attendance upon each. Three scholarships are offered to young men and three to young women. No scholarship will be awarded to a candidate whose examination average is below 80 per cent. Candidates for these scholarships will take the May entrance examinations for the undergraduate course leading to the degree of Bachelor of Arts or the degree of Bachelor of Science, as they shall elect, and on the results of these examinations the scholarships will be assigned. Holders of these scholarships will be expected to pursue a regular course in the Department of Arts and Sciences leading to a degree. Such students will pay only the matriculation, library, laboratory, and graduation fees.

DAVIS SCHOLARSHIP.—This is the income of a fund of one thousand dollars given to the University in October, 1869, by Hon. Isaac Davis, of Massachusetts.

MARY LOWELL STONE SCHOLARSHIP.—This scholarship was founded by a woman in memory of a woman student of science. It consists of a fund of two thousand dollars, the income from which is to be paid to needy women students of science in the University; it will be awarded by the President's Council.

MARIA M. CARTER SCHOLARSHIP.—This is the income of a fund of one thousand dollars given to the University in 1871 by Mrs. Maria M. Carter.

FARNHAM SCHOLARSHIP.—This is the income of a fund of one thousand dollars given to the University in 1871 by Mrs. Robert Farnham.

ADMIRAL POWELL SCHOLARSHIPS.—The Admiral Powell Scholarships were founded by the late Admiral Powell, U. S. Navy. The income from this endowment is for "the free education of such young men as may desire to take advantage of the said endowment by way of their preparation for entrance into the Naval Academy

at Annapolis, Maryland, or such as may fit them to become mates or masters in the Merchant Marine Service of the United States," and of "such apprentices as, having filled their time in the great steam manufactory establishments of the country, may apply for appointment from civil life in the Steam Engineer Department of the United States Navy." The number of scholarships awarded each year will be determined by the income from the endowment. Each scholarship will entitle the beneficiary to free tuition for one year. Such special courses of study are offered to each student as will give him the instruction needed to accomplish the purpose for which he is awarded the scholarship.

These scholarships are especially applicable to those who intend to come up for examination as warrant officers in the Engineer Department of the Navy, or to those who desire to fit for responsible positions in the mercantile marine.

The subjects to be taken by a student will vary according to his preparation and according to the purpose for which he has been awarded the scholarship, but a year's work can be selected from the following topics:

	Hours.
Navigation and Nautical Astronomy	6
Algebra and Geometry	3
Trigonometry	1½
Mechanical and Machine Drawing	4
Meteorology	2
English	3
French	3
German	3
Spanish	3
International Law	1
Commercial Geography	1
Admiralty Law	½
Boilers and Power Plants	3
Measurement of Power	3
Dynamo theory	2
" testing	3

DAVIS PRIZE SPEAKING.

The Davis Prize Speaking is held in University Hall on the Wednesday after the Easter holidays. The Davis Prizes were founded by Hon. Isaac Davis, of Massachusetts, in 1847. The original endowment was five hundred dollars, "proceeds of which will afford three premiums, in cash or gold medals, of the value of $5, of $10, and of $15 annually—these premiums or prizes to be

distributed annually to such members of the senior class as shall have made the greatest progress in elocution since their connection with the College."

The award of these three prizes is determined by a public speaking contest, in which the participants deliver original orations. Senior students wishing to enter the competition should report to the Head Professor of English not later than five weeks before the contest, and submit their orations not later than three weeks before the contest. The prizes are awarded by a committee consisting of three members, selected by the President's Council.

ENOSINIAN SOCIETY.

The Enosinian Society, a literary association formed by the students of Columbian College, to which any University student is eligible, meets regularly for the purpose of improvement in debate and composition.

This society had its beginning March 6, 1822, during the first session of Columbian College, when a number of students held a meeting "for the purpose of establishing a debating society." Two Enosinian prizes are given annually and are publicly delivered at the Commencement. They are the following:

DEBATERS' PRIZE.—A gold medal given by the Society for proficiency in debate. This prize was awarded in 1905 to Augusta Moulton De Forest.

GORE PRIZE IN PARLIAMENTARY LAW.—A gold medal given by Prof. James Howard Gore for proficiency in parliamentary law. This prize was awarded in 1905 to Walter J. Bennett.

THE COLLEGE CHAPEL.

Chapel services are conducted in West Hall on Monday, Tuesday, Thursday, and Friday mornings throughout the academic year, at 9.10 o'clock. The College Chapel is conducted by the Faculty, and all students are invited to help sustain the service. On Wednesdays, at 12 o'clock, the College students participate in the University Assembly, which is held in University Hall.

The Dean of the College will confer with students on questions concerning their welfare and will co-operate with them in furthering the ethical and religious interests of the College.

Official announcements are made regularly at the University Assembly, and professors and students are expected to be governed by them.

III. WASHINGTON COLLEGE OF ENGINEERING.

FACULTY.

CHARLES WILLIS NEEDHAM, LL.D.,.......PRESIDENT OF THE UNIVERSITY
HOWARD LINCOLN HODGKINS, Ph.D....Dean and Professor of Physics
JAMES HOWARD GORE, Ph.D.................Professor of Mathematics
HERMANN SCHOENFELD, Ph.D., LL.D.............Professor of German
CHARLES E. MUNROE, Ph.D.....................Professor of Chemistry
WILLIAM ALLEN WILBUR, A.M...................Professor of English
GEORGE N. HENNING, A.M...........Professor of Romance Languages
PERCY ASH, C.E...........................Professor of Architecture
GEORGE P. MERRILL, Ph.D........Professor of Geology and Mineralogy
HENRY A. PRESSEY, Ph.D..............Professor of Civil Engineering
C. WILLIAM A. VEDITZ, Ph.D., LL.B...........Professor of Economics
FRANK VAN VLECK, M.E.........Professor of Mechanical Engineering
EDWARD ADAMS MUIR, B.S............Assistant Professor of Graphics
N. MONROE HOPKINS, Ph.D..........Assistant Professor of Chemistry
PHILANDER BETTS, E.E...Assistant Professor of Electrical Engineering
EDWIN A. HILL, Ph.D..............Assistant Professor of Chemistry
THOMAS MALCOLM PRICE, Ph.D.......Assistant Professor of Chemistry
R. S. BASSLER, Ph.D...................Assistant Professor of Geology
SHERMAN M. WOODWARD, M.S..........Acting Assistant Professor of Mechanical Engineering
OSCAR QUICK, A.M............................Instructor in Physics
F. L. MOLBY........................Instructor in Freehand Drawing
ISAAC ALLISON, E.E..........................Instructor in Graphics
OTIS D. SWETT, B.S........................Instructor in Chemistry
PAUL NOBLE PECK, A.M....................Instructor in Mathematics
DE WITT C. CROISSANT, A.B.....................Instructor in English
OSCAR L. KEITH, A.M...............Instructor in Romance Languages
ALFRED F. W. SCHMIDT, A.M...................Instructor in German
EDWIN V. DUNSTAN, B.S...............Instructor in Civil Engineering
ARTHUR B. ILSLEY, B.S................Instructor in Civil Engineering
EDWIN SMITH, JR...........................Assistant in Chemistry
WILLIAM E. HILLYER, M.S....................Assistant in Chemistry

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The session of 1906-1907 begins Wednesday, September 26, 1906.

The main building of the University, in which the general studies in this department are conducted, is University Hall, corner Fifteenth and H streets, N. W. The office of the Dean of the College is in this building.

The engineering laboratories and the shops and drawing rooms are in the Van Ness House, on the new site of the University, Seventeenth and B streets N. W. A number of the class-room courses in engineering are also given in this building.

ADMISSION.

Every applicant for admission is required to present a testimonial of good character, and also a certificate of standing and regular dismissal from the school or college which he has attended or from the tutor with whom he has studied.

Candidates for admission to the Freshman Class may present certificates of admission or take an examination in the required subjects. Certificates, in lieu of any or all examinations, will be accepted from schools whose work is attested by well-prepared students admitted to the University in previous years, and from schools desiring co-operation with the University, that present evidence of affording adequate preparation in the required subjects. The Registrar of the University will, on application, furnish certificate blanks to the principals of such accredited schools.

The certificate of the College Entrance Examination Board will be accepted in so far as the subjects specified meet the requirements for admission.

The certificate of the Washington high schools covering all the requirements for admission admits students without examination to the courses of the Freshman year.

The certificates of all schools accredited to the University will be accepted in so far as they specifically meet the requirements for admission.

The general requirement for admission is a four-year high school course, or its equivalent, consisting usually of four or five recitations per week in four or more topics. The high school studies which may be presented in satisfaction of the requirements of admission are given on pages 40-41 of this Catalogue.

Candidates for admission to the Freshman Class in the College of Engineering are required to present fifteen units for admission, distributed as follows:

	Units.
English	4
French or German	4
Plane and Solid Geometry	1½
Elementary and Advanced Algebra	1½
Plane Trigonometry	½
Chemistry	1
Physics	1
Electives	1½
	15

NOTE.—The modern language requirement may be satisfied by presenting four units in one language, or two units in French and two units in German. Students who present four units in one language will study the other language two years in College. Students who present two units in French and two units in German will study each language one year in College.

ADMISSION TO ADVANCED STANDING.

Candidates for admission to advanced classes in any department are examined in all indispensable preliminary studies.

Due credit is given for properly certified courses of study pursued in other colleges and universities.

ADMISSION TO SPECIAL COURSES.

All the courses of instruction are open to students of suitable age and attainments who wish, without reference to any degree, to pursue special studies. Candidates are examined in each special study. They must be familiar with the subjects preliminary to the studies which they wish to pursue.

AUDITORS.

Certain courses are open to the public on payment of an auditor's fee. Auditors are without responsibility for class exercises or examinations, and they will receive no credit on the records.

COURSES FOR A DEGREE.

Three courses of study are offered:

I. CIVIL ENGINEERING.
II. ELECTRICAL ENGINEERING.
III. MECHANICAL ENGINEERING.

These courses occupy four years each, and lead to the degree of Bachelor of Science in Civil Engineering, in Electrical Engineering, and in Mechanical Engineering, respectively. Graduate courses of one year under the Faculty of Graduate Studies of the George Washington University are open to those who receive the above degrees, and lead, respectively, to the degrees of Civil Engineer, Electrical Engineer, and Mechanical Engineer.

The courses in engineering are planned to give the student a thorough understanding of the theory underlying engineering practice, and such a practical knowledge of the instruments and methods

of his particular profession as will enable him to apply the theory properly. In all the courses a thorough training in mathematics, pure and applied, and in drawing and descriptive geometry is required as the basis of the analytical and graphical study of engineering topics. Much stress is laid on the work in the drawing-room and laboratory. The work is planned to give him a thorough knowledge of principles upon which he may build, and by which he may be able to solve the new problems he meets in practice.

The work of the first year is the same for all students. It is taken up partly with general studies which have both an educational and a cultural value, and partly with work in mathematics and drawing which lays the foundations for the subsequent courses. In each of the other years there are studies taken in common by all engineering students, these studies including courses in English, in French and German, in pure and applied mathematics, in drawing and descriptive geometry, in chemistry and in physics. The requirement in French and German is intended to give the student an accurate reading knowledge of these languages, with particular reference to scientific literature.

Beginning with the Sophomore year, the Civil Engineering student enters upon his technical studies, continuing at the same time a number of topics of a more general character, and in the Junior and Senior years the work becomes yet more specialized. He begins with a general course in surveying and follows this with courses in railroad and highway location and construction. Theoretical hydraulics and hydraulic engineering receive careful and detailed treatment and much stress is laid on sanitary work, both in its theory and applications. A preliminary course in engineering materials and simple constructions in the Sophomore year is followed in later years by extended courses in mechanics of materials, and in the theory and design of structures in wood, steel, and masonry, in which are applied the knowledge gained in the courses in mechanics and graphic statics.

The courses for Electrical and Mechanical Engineering students are the same during the Sophomore year, and beside the general studies required of all engineering students include courses in advanced drawing and design and in kinematics of machinery. Shopwork begins in this year and continues until the end of the course for both classes of students, although the Electrical students give less time to it than do the Mechanical students. The purpose of the work is not primarily to give manual skill, but to give such an understanding of tools and processes as will be of assistance in designing and in superintending. In the Junior Year Electrical and Mechanical students continue work in machine design, and take courses in steam engineering and on boilers and power plants.

The Electrical students begin their special work in electricity in the Junior Year. Theoretical electricity is first studied, and is followed by

engineering electricity, and by courses on direct current machinery. In the laboratory, experimental work in exact measurements is followed by the study of the dynamo. In the drawing-room are studied related problems in design. In the Senior Year alternating current machinery is studied, both theoretically and practically; and courses on the applications of electricity and on light and power distribution are taken. Many hours are given to work in the electrical and general engineering laboratories.

The Mechanical Engineering students, in addition to the courses which they take in common with the electrical students, have courses in engine design, including steam and gas engines; in hydraulic and hydraulic machinery; in machinery of transmission; and a brief course in engineering electricity, considering electrical machinery from the standpoint of one who is to use it rather than to design it.

The engineering courses are partly lecture and partly laboratory and drawing-room courses, the plan being to give the theory in the class-room, to illustrate the theory in the laboratory, and to have the student apply the theory, from given data, in the drawing-room.

REQUIREMENTS FOR A DEGREE.

The arrangement of the topics in each of the regular courses for a degree is shown below. The numbers following the names of subjects refer to the courses as given in the list of University Subjects on pages 73 to 129, to which reference should be made for more complete description.

COMMON TO ALL COURSES.

Freshman Year.

	Units.
Architecture, 1 Freehand Drawing.	1
Chemistry, 1, 7 General Chemistry and Qualitative Analysis.	5
English, 1 or 2 Rhetoric.	3
French or German	3
Graphics, 1 Mechanical Drawing.	2
Mathematics, 9, 11 or 12, 14 Trigonometry; Analytic Geometry.	3

CIVIL ENGINEERING COURSE.

Sophomore Year.

	Units.
Civil Engineering, 1, 4	5
Surveying; Materials of Construction.	
French or German	3
Graphics, 8, 10	4
Descriptive Geometry; Topographic Drawing.	
Mathematics, 20, 22 or 21, 22	3
Calculus; Differential Equations.	
Physics, 1, 2	5
General Physics; Laboratory Physics.	

Junior Year.

	Units.
Applied Mathematics, 20, 21	4½
Mechanics; Hydraulics.	
Astronomy	2
Civil Engineering, 2, 3, 5, 7	7
Railroad Engineering; Highways and Pavements; Water-works; Engineering Testing.	
Electrical Engineering, 6	1
Industrial Engineering.	
Graphics, 20	3
Graphic Statics.	
Geology	2

Senior Year.

	Units.
Applied Mathematics, 22	2
Mechanics of Materials.	
Chemistry, 6	1
Metallurgy.	
Civil Engineering, 6, 20, 21, 22	11½
Sewerage; Masonry; Hydraulic Engineering; Framed Structures.	
Economics	2
Mechanical Engineering, 5	2
Steam Engineering.	

ELECTRICAL ENGINEERING COURSE.

Sophomore Year.

	Units.
French or German	3
Graphics, 2, 8	5
Advanced Mechanical Drawing; Descriptive Geometry.	
Mathematics, 20, 22 or 21, 22	3
Calculus; Differential Equations.	
Mechanical Engineering, 2, 8	4
Mechanism; Shop-work.	
Physics, 1, 2	5
General Physics; Laboratory Physics.	

Junior Year.

	Units.
Applied Mathematics, 20, 21	4½
Mechanics; Hydraulics.	
Electrical Engineering, 1, 2, 3, 4, 5	8
Elementary Electricity; Direct Current Machinery; Electrical Engineering; Electrical Measurements; Electrical Engineering Laboratory.	
Mechanical Engineering, 1, 3, 5, 8	6½
Machine Design; Boilers and Power Plant; Steam Engineering, Shop-work.	

Senior Year.

	Units.
Applied Mathematics, 22	2
Mechanics of Materials.	
Chemistry, 6	1
Metallurgy.	
Electrical Engineering, 21, 22, 23, 24	10
Alternating Currents; Electrical Distribution; Electrical Applications; Electrical Engineering Laboratory.	
Economics	2
Mechanical Engineering, 4, 23, 25	4
Boilers and Power Plants; Hydraulic Machinery; Engineering Laboratory.	

MECHANICAL ENGINEERING COURSE.

Sophomore Year.

	Units.
French or German	3
Graphics, 2, 8	5
Advanced Mechanical Drawing; Descriptive Geometry.	
Mathematics, 20, 22 or 21, 22	3
Calculus; Differential Equations.	
Mechanical Engineering, 2, 8	4
Mechanism; Shop-work.	
Physics, 1, 2	5
General Physics; Laboratory Physics.	

Junior Year.

	Units.
Applied Mathematics, 20, 21	4½
Mechanics; Hydraulics.	
Graphics, 20	3
Graphic Statics.	
Mechanical Engineering, 1, 3, 5, 6, 7, 9	11½
Machine Design; Boilers and Power Plants; Steam Engineering; Engineering Drawing; Mechanical Laboratory; Shop-work.	

Senior Year.

	Units.
Applied Mathematics, 22	2
Mechanics of Materials.	
Chemistry, 6	1
Metallurgy.	
Economics	2
Electrical Engineering, 7	3
Dynamos and Motors.	
Mechanical Engineering, 4, 10, 20, 21, 23, 24, 25	10
Boilers and Power Plants; Shop-work; Steam Engineering; Gas Engines; Hydraulic Machinery; Machinery of Transmission; Mechanical Laboratory.	

PRIZES.

Only candidates for degrees may compete for these prizes.

RUGGLES PRIZES.—The Ruggles Prizes, for excellence in Mathematics, founded by Professor William Ruggles, LL.D., consist of two gold medals, annually awarded upon examination to the best two scholars in Mathematics.

MUNROE PRIZE.—Professor Munroe offers a gold medal to that student from any Washington high school or the Manual Training School who shall attain the highest mark in Chemistry among those passing the entrance examinations, and shall remain in regular attendance for one year.

CLASS OF '96 JAMES MACBRIDE STERRETT, JR., MEMORIAL MEDAL.—This prize is annually awarded to that student taking Course 1 in Physics who obtains the highest average in a special examination on a given subject and in the writing of an essay on an assigned topic.

DAVIS PRIZES.—The Davis Prizes, for excellence in Elocution, founded by the Hon. Isaac Davis, LL.D., of Massachusetts, consist of three gold medals, annually awarded to the successful competitors in a public contest. Members of the Senior Class are eligible to compete for these prizes.

SCHMIDT PRIZE.—Mr. Fred. A. Schmidt offers a prize to the student who attains the highest standing in Descriptive Geometry, Trigonometry, and Analytic Geometry.

MUTH PRIZE.—Geo. F. Muth & Co. offer a set of Drawing Instruments to the student taking Machine Drawing who makes the highest average record in that subject and in the previous year's Mechanical Drawing.

SCHOLARSHIPS.

Application for scholarships should be filed with the Dean not later than September fifteenth. All scholarships except the Kendall Scholarship and the University Scholarships are awarded for one year only, but they may be renewed. Any student holding a scholarship who fails to obtain a general average of 85 per cent. on the work of any term or whose deportment is unsatisfactory will be reported to the President's Council, and in the absence of extenuating circumstances the scholarships will be revoked.

KENDALL SCHOLARSHIP.—The Kendall Scholarship, founded by the late Hon. Amos Kendall, is annually conferred on that student from any of the Washington high schools or from the Manual

Training School who attains the highest average in the May entrance examinations. This scholarship continues throughout the undergraduate course, and the student holding it pays only the matricu-only the matriculation, library, laboratory and graduation fees.

University Scholarships.—The University offers also six scholarships, each continuing throughout the undergraduate course, to be awarded annually to members of the graduating classes of the high schools of Washington and of the Manual Training School. The scholarships will be divided among the several schools in proportion to the number of students in attendance upon each. Three scholarships are offered to young men and three to young women. No scholarship will be awarded to a candidate whose examination average is below 80 per cent. Candidates for these scholarships will take the May entrance examinations for the undergraduate course leading to the degree of Bachelor of Arts or the degree of Bachelor of Science, as they shall elect, and on the results of these examinations the scholarships will be assigned. Holders of these scholarships will be expected to pursue a regular course in the Department of Arts and Sciences leading to a degree. Such students will pay only the matriculation, library, laboratory, and graduation fees.

Henry Harding Carter Scholarship.—These scholarships, founded by Mrs. Maria M. Carter in memory of her husband, Henry Harding Carter, consist of four scholarships of the annual value of fifty dollars each, and may be awarded to deserving students who are preparing for the civil engineering profession.

Admiral Powell Scholarships.—The Admiral Powell Scholarships were founded by the late Admiral Powell, U. S. Navy. The income from this endowment is for "the free education of such young men as may desire to take advantage of the said endowment by way of their preparation for entrance into the Naval Academy at Annapolis, Maryland, or such as may fit them to become mates or masters in the Merchant Marine Service of the United States," and of "such apprentices as, having filled their time in the great steam manufactory establishments of the country, may apply for appointment from civil life in the Steam Engineer Department of the United States Navy." The number of scholarships awarded each year will be determined by the income from the endowment. Each scholarship will entitle the beneficiary to free tuition for one year. Such special courses of study are offered to each student as will give him the instruction needed to accomplish the purpose for which he is awarded the scholarship.

These scholarships are especially applicable to those who intend to come up for examination as warrant officers in the Engineer

Department of the Navy, or to those who desire to fit for responsible positions in the mercantile marine.

The subjects to be taken by a student will vary according to his preparation and according to the purpose for which he has been awarded the scholarship, but a year's work can be selected from the following topics:

	Hours.
Navigation and Nautical Astronomy	6
Algebra and Geometry	3
Trigonometry	1½
Mechanical and Machine Drawing	4
Meteorology	2
English	3
French	3
German	3
Spanish	3
International Law	1
Commercial Geography	1
Admiralty Law	½
Boilers and Power Plants	3
Measurement of Power	3
Dynamo Theory	2
Dynamo Testing	3

IV. DIVISION OF ARCHITECTURE.

FACULTY.

CHARLES WILLIS NEEDHAM, LL.D., ... PRESIDENT OF THE UNIVERSITY
PERCY ASH, B.S. .... Professor of Architecture in charge of the Division of Architecture
JAMES HOWARD GORE, Ph.D. .... Professor of Mathematics
HOWARD LINCOLN HODGKINS, Ph.D. .... Professor of Physics
CHARLES E. MUNROE, Ph.D. .... Professor of Chemistry
HERMANN SCHOENFELD, Ph.D., LL.D. .... Professor of German
CHARLES CLINTON SWISHER, Ph.D., LL.D. .... Professor of History
WILLIAM ALLEN WILBUR, A.M. .... Professor of English
MITCHELL CARROLL, Ph.D. .... Professor of Classical Philology
GEORGE N. HENNING, A.M. .... Professor of Romance Languages
HENRY A. PRESSEY, Ph.D. .... Professor of Civil Engineering
GEORGE LANSING RAYMOND, L.H.D. .... Professor of Æsthetics
ALBERT BURNLEY BIBB .... Professor of Architecture
N. MONROE HOPKINS, Ph.D. .... Assistant Professor of Chemistry
EDWIN A. HILL, Ph.D. .... Instructor in Chemistry
F. L. MOLBY .... Instructor in Freehand Drawing
OTIS D. SWETT, B.S. .... Instructor in Chemistry
DE WITT C. CROISSANT, A.M. .... Instructor in English
OSCAR L. KEITH, A.M. .... Instructor in Romance Languages
PAUL N. PECK, A.M. .... Instructor in Mathematics
ISAAC ALLISON, B.S., E.E. .... Instructor in Graphics
ALFRED F. W. SCHMIDT, A.M. .... Instructor in German
EDWIN V. DUNSTAN, B.S. .... Instructor in Civil Engineering
CHARLES MASON REMEY .... Instructor in Architecture
EDWIN SMITH, JR. .... Assistant in Chemistry
HUBERT P. ILLMAN .... Assistant in Architecture

ADMISSION.

Every applicant for admission is required to present a testimonial of good moral character, and also a certificate of standing and regular dismissal from the school or college which he has attended or from the tutor with whom he has studied.

Candidates for admission to the Freshman Class may present certificates of admission or take an examination in the required books and subjects.

The general requirement for admission is a four-year high school course, or its equivalent, consisting usually of four or five recitations per week in four or more topics.

Candidates for admission to the course leading to the degree of Bachelor of Science are required to present subjects from the list of high school studies aggregating fifteen units, distributed as follows:

	Units.
English	4
French or German	2
Elementary Algebra	1
Plane Geometry	1
Physics	1
Chemistry	1
Electives	5
	15

The list of high school studies and the definition of requirements in all preparatory subjects are given on pages 40-50 of this Catalogue.

REQUIREMENTS FOR THE DEGREE OF BACHELOR OF SCIENCE IN ARCHITECTURE.

To be recommended for the degree of Bachelor of Science in Architecture the student must be registered in the Division of Architecture for at least one academic year, he must satisfy the admission requirements, and must complete the prescribed course for the degree. This is a four-year course. General culture studies are pursued through the first two years, about half of the time being devoted to them. The rest of the course is devoted to architectural work. The unit of credit is one hour of recitation or lecture per week throughout the academic year. Laboratory hours count one-third unit each.

First Year.

	Units.
English	3
Mathematics	3
French, Italian, or German	3
Chemistry	5
Architectural Drawing	4
Shades, Shadows, and Perspectives	2
Freehand Drawing	1
	21

Second Year.

	Units.
English	3
Mathematics	3
French, Italian, or German	3
Physics	5
Rendering, Design	4
Freehand Drawing	1
History of Architecture	2
	21

Third Year.

	Units.
Mechanics of Material (First term) Graphic Statics (Second term)	3
Building Construction	2
Sanitary Enginering of Buildings	1
History of Architecture	3
Pen and Ink Rendering	1
Design and Sketch Design	6
Drawing from the Antique	2
Water Colors	1
	19

Fourth Year.

	Units.
Design and Sketch Design—Thesis	7
Modeling (Architectural)	1
Pen and Ink Rendering	1
Classical Archæology	2
History of Painting and Sculpture	1
Building Construction	2
Drawing from Life	2
Water Colors	1
History of Architecture	3
	20

A special course of three years may be arranged for qualified students who wish to take the purely technical work of the Architectural course. Special students may receive a certificate on the satisfactory completion of the course for which they are registered.

PRIZE.

The Washington Architectural Club offers membership in the Club as a prize in Architecture. In 1903–04 this prize was awarded to Charles R. Lombard. In 1904–05 to W. H. I. Fleming.

Department of Arts and Sciences.

COURSES OF INSTRUCTION.

UNIVERSITY SUBJECTS.

University Subjects are divided into three sections, in accordance with the following requirement of an ordinance adopted by the Board of Trustees October 13, 1902:

ARTICLE IV.—*Development of University Subjects.*

SECTION 1. Subjects shall be divided into three sections, as follows:

(1) The fundamental section, covering two years' work; this section to be assigned to students in the general-culture courses.

(2) The advanced section, not exceeding three years; this section to be assigned to students specializing for literary, scientific, professional, or industrial pursuits.

(3) The original research section; this section to be assigned to students pursuing a subject for discovery and broader culture.

The courses in the first section are sometimes recommended to graduate students, but are not ordinarily counted toward the higher degrees The courses in the second section are in general for advanced students, candidates for the Bachelor's degree; they serve, however, with additional work as minors for the higher degrees, provided they have not already counted toward a degree. They may be taken by students in the second year of their course only by special permission of the professor in charge. The courses in the third section are in general for graduate students only, candidates for one or other of the higher degrees. They are open to undergraduates only on the recommendation of the instructors, and no undergraduate student shall take in one year more than one course in the third section. When an announced course has not been applied for by at least three students, candidates for a degree, the instructor may withdraw the course. First-section courses are numbered from 1 to 19, inclusive; second-section courses from 20 to 39, inclusive; third-section courses are numbered on from 40. The number of hours, unless otherwise specified, indicates hours per week throughout the year. The unit of credit is one hour of recitation or lecture work per week for one academic year; laboratory hours in Chemistry and Architecture count one-third unit each, in other subjects one-half unit each. Sixty units of credit is the minimum requirement for the Bachelor's degree. Laboratories and drawing-rooms will be open from 9.30 a. m.

till 10 p. m., with competent assistants in charge to direct students. No student is admitted to a course unless he fulfils all of the preliminary requirements for that course, or otherwise satisfies the instructor that he is prepared to pursue it. Every student must make his election of courses so as to avoid conflict between the hours appointed for recitations.

ANATOMY.

D. Kerfoot Shute, A.B., M.D. .... *Professor*
W. F. R. Phillips, M.D. .... *Assistant Professor*
S. H. Greene, Jr., M.D. .... *Instructor*
J. L. Riggles, M.D. .... *Instructor*
George M. Ruffin, M.D. .... *Instructor*

Second Section. For Undergraduates and Graduates.

20. The course in Anatomy is given in a series of lectures, demonstrations, recitations from text-books, and practical laboratory work. The purpose of the lectures is to prepare the student for his practical work in the laboratory. The lectures are illustrated by lantern slides, models, charts, and diagrams.

Primarily for students of medicine; open to advanced students in Arts and Sciences.

First half-year, *Mon.* to *Sat.*, incl., 8 a. m.
Laboratory, *Mon.* to *Fri.*, incl., 9-12 a. m.

Third Section. Primarily for Graduates.

40. Anatomy of the Nervous System.—This course includes laboratory work, readings, and recitations. The nervous system is investigated in typical animals of the different classes, especially with the view of gaining some insight into the phylogeny of the central nervous system in man. The growth of the brain and its physical characters as related to intelligence are investigated. The histology and embryology of the central nervous system and the sense organs are studied. A history of the guiding conceptions in neurology is to be acquired. The course is designed to inculcate a sound knowledge of the architecture and functions of the nervous system of man for the use of students of anatomy, medicine, and psychology. Two hours. Professor Shute.

APPLIED MATHEMATICS.

HENRY A. PRESSEY, Ph.D. .... *Professor*
EDWIN V. DUNSTAN, B.S. .... *Instructor*

Second Section. For Undergraduates and Graduates.

20. Analytical and Applied Mechanics. (1) Statics: including the composition, resolution, and equilibrium of forces; center of gravity; friction; machines. (2) Kinematics and Kinetics: including rectilinear and curvilinear motion; motion under action of variable forces and in resisting media; constrained and rotatory motion; impact; work and energy; moment of inertia. *Mon.*, at 9.30; *Wed.*, at 9; *Fri.*, at 9.30.

21. Hydraulics. The theoretical principles of hydraulics; hydrostatics; flow through orifices, over weirs, through pipes and in open channel; hydraulic formulas; coefficients; water mains; current meters, floats. Hydraulic experiments are conducted in the laboratory in connection with this course. Text-book, Merriman's Hydraulics. *Mon.*, at 10.30; *Wed.*, at 10; *Fri.*, at 10.30; first half-year.

22. Mechanics of Materials and Theory of Elasticity, including elastic and ultimate strength and deformation; simple, cantilever and continuous beams; columns; torsion; combined stresses; compound columns and beams, including reinforced concrete; resilience; work; fatigue; mathematical theory of elasticity. *Wed.*, *Fri.*, at 4.50.

ARCHÆOLOGY, CLASSICAL.

MITCHELL CARROLL, M.A., Ph.D. .... *Professor*

Second Section. For Undergraduates and Graduates.

The following cycle of courses in Classical Archæology is given, extending over a period of three years. Each course consists of weekly lectures and conferences illustrated by maps, plans, photographs, and lantern slides, supplemented by a prescribed course of reading and the preparation of papers on special topics. The work constitutes a two-hour elective, or either the lectures on Mondays or the class conferences on Thursdays may be taken as a one-hour elective. A knowledge of Greek or Latin is not essential.

20. Topography and Monuments of (*a*) Athens and (*b*) Rome. A study of the history, topography, and monuments of the chief centers of ancient life. Given in 1906-07. *Mon.*, *Th.*, at 4.50.

21. Life of the Greeks and Romans. Selected topics in Private and Public Life; family organization; the state, the constitution, assemblies, magistracies; the ancient house, its architecture, furniture, and ornamentation; education, occupations, and amusements; dress, arms, and armor; religious festivals, rites, and ceremonies; and similar themes. Given in 1905-06. *Mon., Th.*, at 4.50.

22. Greek and Roman Architecture and Sculpture. Not given in 1906-07; given in 1907-08.

In all these courses considerable use is made of the illustrative material accessible in the Library of Congress, the Corcoran Gallery of Art, and the Smithsonian Institution.

ARCHITECTURE.

Percy Ash, B.S. ....*Professor in charge*
Albert Burnley Bibb ....*Professor*
Chas. Mason Remey ....*Instructor*
Frank L. Molby ....*Instructor in Freehand Drawing*
Hubert P. Illman ....*Assistant*

Instruction in drawing from the antique and life is given at the Corcoran Gallery of Art by Mr. Brooke, Miss Mueden, and Mr. Messer.

The following architects have given criticisms on design, in addition to the regular corps of instructors: Nathan C. Wyeth, Architecte diplomé par le Gouvernment; E. Frerè Champney, E. W. Donn, Jr.

First Section. Primarily for Undergraduates.

1. Freehand Drawing. This course consists of drawing, in charcoal, of simple objects, in which particular attention is paid to the study of values and form. *Mon., Sat.*, at 5.40. Mr. Molby.

2. Freehand Drawing. For architectural students primarily. This course begins with drawing, in charcoal, of simple objects, such as cubes, cones, etc., and is followed by a series of drawings from architectural casts. Particular attention is paid to the study of values and form. *Mon., Sat.*, at 4.50. Mr. Molby.

3. Architectural Drawing and Elementary Design. This course includes the study of the Five Orders of Architecture, the use of India ink, and water-color rendering. In addition, each student is required to measure some building in the city, and from the notes thus obtained make a completed Rendu in India ink or color. Lectures on the Five

Orders on Tuesday, at 4.50 and instruction in the use of color and rendering in India ink on Thursday, at 4.50, and at least ten additional hours in the drafting-room. Professor ASH.

4. Shades, Shadows, and Perspectives. A course in orthographic projections, shades, shadows, and perspectives. *Wed., Fri.*, at 4.50. Mr. REMEY.

5. Rendering and Design. In this course the instructions in India ink rendering and the use of water colors given in the first year are continued. At least twelve hours each week are devoted to the problems in design. Six regular problems and six sketch problems constitute the course in design. Criticism, *Mon., Wed., Fri.*, at 10 a. m. Professor ASH.

6. Freehand Drawing. The drawing from architectural casts in both charcoal and pencil continues the work begun in the first year, and is intended to fit the student for his subsequent freehand drawing from the antique. *Mon., Sat.*, at 4.50, and at least two additional hours. Mr. MOLBY.

Second Section. For Graduates and Undergraduates.

20. History of Architecture. History of Classical and Early Christian architecture. Illustrated. Two lectures per week. *Tu.*, at 4.50; *Th.*, at 5.40. Professor BIBB.

21. Building Construction. Frame construction and interior finish. *Wed., Fri.*, at 5.40. Professor BIBB.

22. Sanitary Engineering of Buildings. One hour.

23. History of Architecture. History of Renaissance architecture. Illustrated. Two lectures per week, and one additional hour for research. *Mon., Fri.*, at 4.50. Professor ASH.

24. Pen and Ink Rendering. A study of the works of the best draftsmen, with practice in the use of the pen as a means of architectural expression. Two hours.

25. Design and Sketch Design. This course embraces problems in plan, in archæology, and in sketch design. Three problems in archæology, three plan problems, and six sketch problems constitute the course. The student is required to spend at least eighteen hours in the drafting-room each week. Criticism, *Mon., Wed., Fri.*, at 10. Professor ASH.

26. Drawing from the Antique. To be eligible for this course the student must have passed satisfactorily Course 6. He is required to

devote at least six hours per week to working from the antique in the Corcoran Gallery of Art under the criticism of the instructor on that subject. Criticism 9 to 12 daily by Miss MUEDEN. Criticism 7 to 10 daily by Mr. BROOKE.

27. Design and Sketch Design. Thesis. Problems of an advanced character are assigned to the student during the first term. Three advanced problems and three sketch problems are required of the student in addition to his thesis. The three months preceding graduation are devoted to the production of the thesis designs, the subject for the thesis being selected by the student. The student is required to spend twenty-one hours each week in the drafting-rooms. Criticism is given three times a week by Professor ASH.

28. Modeling (Architectural). This course will be arranged and an instructor appointed at an early date.

29. Pen-and-ink Rendering, being a continuation of the work begun in the third year. The work consists largely of the making of pen-and-ink drawings from photographs of architectural subjects. Two hours per week are devoted to this work.

30. Classical Archæology. A study of the life, art, topography, and monuments of Athens and Rome. *Mon.*, and *Th.*, at 4.50. Professor CARROLL. (See section on Archæology.)

31. History of Painting and Sculpture. This course will comprise a series of illustrated lectures on painting and sculpture. The details of the course will be given later.

32. History of Mediæval Architecture. Two lectures and one hour for research per week. Professor BIBB.

33. Building Construction. Masonry, cements, foundations, soils, etc. *Mon.*, at 5.40, *Wed.*, at 4.50. Professor ASH.

34. Water Colors. Beginning by the sketching of simple forms in the studio and followed by excursions into the country for direct sketching from nature. Two hours per week. Professor BIBB.

35. Drawing from Life. To complete this course the student is required to spend at least six hours per week in the Life Class at the Corcoran Gallery of Art. Only students who have satisfactorily passed Course No. 26 are admitted to this class. Men's life; women's life. Criticism by Mr. MESSER.

36. Water Colors. Continuation of Course 34. A course in water-color sketching. Two hours per week. Professor BIBB.

37. A special course in design will be given, consisting of six regular and six sketch problems. This course is intended to prepare students for the Beaux Arts problems. Criticisms, *Mon., Wed., Fri.,* at 7.30.

38. In this course the problems prepared by the New York Society of Beaux Arts Architects will be offered to the students, and the judgments will be made by the jury in New York city under the rules of the society. Criticisms, *Mon., Wed., Fri.,* at 7.30.

39. Summer Work. Each architectural student is required during the summer vacation to make at least twenty-four sketches from nature, or to do an equivalent amount of work, namely, four weeks in an architect's office, or the measured drawings of an existing monument of architecture.

Third Section. Primarily for Graduates.

40. Composition as applied to architecture.

41. Advanced design.

NOTE.—Course 37 and 38 are designed for student draftsmen who wish to supplement their regular office work with special training in design rendering, etc.

The Architectural League of America offers an annual Traveling Scholarship in Architecture, value $1,200 to students and draftsmen in Architecture under 35 years of age. All architectural students in the University, who are members of the George Washington University Archictectural Club are eligible to compete for this prize.

ASTRONOMY.

EDGAR FRISBY, A.M. .... *Professor*
HERBERT LOUIS RICE, M.S. .... *Professor*

Third Section. Primarily for Graduates.

40. The Theory of Computing the Parabolic Orbit of a Comet from Three Observations, with an ephemeris. Encke's Memoir on Olbers' Method, Abhandlungen, Erster Band. Books of reference: Watson's Astronomy, Oppolzer's Bahnbestimmung der Cometen und Planeten. Professor FRISBY.

41. The Theory of Computing an Elliptical Orbit, or any Conic Section, from Three or Four Observations. Gauss' Theoria Motûs. Books of Reference, as above. Professor FRISBY.

42. An outline of the Method of Least Squares. Encke, Chauvenet, Brunnow, Watson, Johnson. Professor FRISBY.

44. The Theory of General Perturbations. Tisserand, Méchanique Céleste. Books of reference: Laplace, Méchanique Céleste; Lagrange, Méchanique Analytique, and Memoirs; Leverrier, Annals of the Paris Observatory; Hansen, Auseinandersetzung; Pontécoulant, Systéme du Monde, etc. Professor FRISBY.

45. General Spherical Astronomy. Chauvenet's or Brünnow's Spherical Astronomy. Professor FRISBY.

50. On the construction and use of the American Ephemeris and Nautical Almanac. Embracing a complete discussion, both theoretical and practical, of all the important elements and data contained in this fundamental work. A practical course for computers. Professor RICE.

51. Spherical and Mathematical Astronomy. A more general course than the preceding, covering the most important of the subjects discussed in Chauvenet's or Brünnow's works on Spherical and Practical Astronomy, and including such portions of Theoretical Astronomy (such as Watson's) as are not especially concerned with the determination of orbits. Professor RICE.

52. On the Theory and Practice of Interpolation. A special course, including a full discussion of the properties of differences, the various formulæ and methods of interpolation, tabular differentiation, and mechanical quadrature; also other important problems concerned, with the tabular values of functions, for those desiring special acquaintance with this fundamental and important subject. Professor RICE.

53. A reading course in the History of Astronomy. Such works as Grant's History of Physical Astronomy, Clerke's History of Astronomy during the Nineteenth Century, etc., are used as texts. Professor RICE.

ASTRO-PHYSICS.

FRANK HAGAR BIGELOW, A.M., L.H.D. .... *Professor*
FREDERICK E. FOWLE, JR. .... *Lecturer*

Third Section. Primarily for Graduates.

40. Solar Physics. The constitution of the sun, the sun-spots, faculæ, prominences, and the coronas; the circulation of the solar mass and the distribution of these phenomena in latitude and longitude, their variations in the 3-year, 11-year, and 35-year periods; the grounds for the theory that the sun is a magnetized body, associated with electric currents and an ionized radiation. Professor BIGELOW.

41. Cosmical Electricity and Magnetism. The two fields of force emanating from the sun, their modes of propagation through the ether as electromagnetic and magnetic types of energy, and their relation to the heat and light received by the earth; the laws of radiation and the determination of the solar constant; the variations in the solar spectrum due to changes in the physical states of the sun's and the earth's atmospheres. Authors: Maxwell, Poincaré, J. J. Thomson, Hertz, Heaviside, Webster, with references to the recent literature in scientific journals. Professor BIGELOW.

42. Terrestrial Magnetism. The distribution and secular variation of the magnetism of the earth, its periodic and irregular disturbances by solar action; magnetic observatories, instruments, and methods of observing; atmospheric electricity and ionization; terrestrial radioactivity and emanations; auroras, magnetic storms, and their relation to the gases of the atmosphere, with a history of the progress of science in these lines of research; the work of the Mount Weather Meteorological Research Observatory in connection with solar physics. Authors: Gauss, Mascart, Stewart, and Gee; numerous reports of observatories and recent scientific papers. Professor BIGELOW.

43. Meteorology. The theories of the general motions of the earth's atmosphere and of the generation of local cyclones and anticyclones, periodic variations in the pressure, temperature and precipitation of the atmosphere due to solar operations; short and long range predictions of the weather for the United States.

The results of the International Cloud Survey of 1896-1897; of the Weather Bureau nephoscope observatories in the West Indies, 1898-1902; a comparative study of the theories of dynamic meteorology; Bigelow's standard system of equations useful in meteorology; the gradients of pressure, temperature, and vapor tension as determined by cloud observations, balloon and kite ascensions; the barometry and thermometry of the United States; eclipse meteorology and allied problems; the new cosmical meteorology; these and related topics are included in this course. Professor BIGELOW.

44. A lecture course on the astro-physical instruments employed in modern research; the siderostat, the coelostat, the bolometer, the spectroheliograph, spectroscopes and telescopes generally, explaining their mechanical parts, the methods of obtaining the instrumental errors, and the formulæ for reducing the observations. To be taken in connection with Courses 40 and 41. Mr. FOWLE.

BACTERIOLOGY AND PATHOLOGY.

James Carroll, M.D. .... *Professor*
T. S. D. Grasty, M.D. .... *Instructor*
H. H. Donnally, M.D. .... *Instructor*

Second Section. For Undergraduates and Graduates.

Primarily for students of medicine; open also to advanced students in Arts and Sciences.

20. Bacteriology: The preparation of the various culture media; the principles of disinfection and sterilization, and the methods of cultivating, staining, and studying bacteria. Special attention is given to pyrogenic organisms and the bacilli of diphtheria and tuberculosis. First half-year, *Mon., Wed., Fri.,* 1 to 3.

21. Pathology. The student is now prepared to appreciate the association of bacteria with certain definite lesions in the tissues. After the detailed study of inflammation, the diseases of the various organs are taken up in succession. For this purpose sections illustrating the various pathological conditions are carefully selected and given to the student to be stained, mounted, and studied under the immediate supervision of an instructor. These sections thereafter become the property of the student. The course terminates with the microscopical study of the several varieties of tumors. Second half-year, *Mon., Wed., Fri.,* 1 to 3.

Third Section. Primarily for Graduates.

40. Bacteriology. Special studies and practical research work. Professor Carroll.

BOTANY.

Albert Mann, A.M., Ph.D. .... *Professor*

First Section. Primarily for Undergraduates.

1. General Botany. The purpose of this course is to afford to students a general but accurate knowledge of Botany as a science. The different plant forms are progressively studied, from the simplest organisms to the most highly specialized and complex (Systematic Botany). The individuals of the series are considered in the following ways: (1) As to their various structures and organs (Morphological Botany); (2) as to the uses and functions of each part (Physiological Botany); (3) as to the individuals as inde-

pendent living organisms (Biological Botany); (4) as to their relations to their places in Nature and the influence of environment (Ecological Botany); (5) as to their relations to other botanical and zoological organisms (Symbiotic Botany); (6) as to their relations to plant forms preceding them geologically (Paleontological Botany). Lectures, *Mon.*, at 1.30. Laboratory work, *Fri.*, 1.30 to 3.30.

2. Applied Botany. This course offers a series of lectures and laboratory investigations bearing on the uses of plants to civilized life. In considering this relationship which gave rise to the science of Botany, a historical excursion is made into the character of the science in former centuries. The main points included in this course are: (1) Plants as the world's food supply, both directly and indirectly; the characteristic plant foods of different zones and countries; the origin of common food plants; the adaptability of various plants to introduction into new areas; the difference in their response to cultivation and selection; the relative nutritive value of different food plants; (2) plants in Medicine; a review of early botanical remedies; a general view of modern Materia Medica; the relations of various plants to disease and to health, including the Bacteria; (3) plants in relation to Art, Æsthetics, and Architecture; the strong influence of plant forms in these fields; plants used as perfumes, condiments, dyes, etc.; (4) plants in relation to the mechanical arts; woods, textile fibers, etc. Lectures, *Tu.*, at 4.50. Laboratory work, *Th.*, 4.50 to 6.30.

Second Section. For Undergraduates and Graduates.

20. Comparative Biology. This course consists of lectures and class-room demonstrations treating of the different functions and phenomena of life as they are exhibited in both animals and plants. The lectures occur once a week, and are given by the Professor of Zoology and the Professor of Botany alternately. They discuss the strictly biological processes in Nature—that is, those classed as vital processes—and show their relations and contrasts as viewed from the two standpoints indicated. The series is based on the general classifications of the two sciences, beginning with the lowest forms. The alternate lectures are in this way coordinated; but aside from this mutual plan of procedure, each lecturer treats the subject independently. Wednesday afternoons, one hour; time to be determined. Professors BARTSCH and MANN.

Third Section. Primarily for Graduates.

40. Geographical Botany. Floral areas and their conditions—temperature, moisture, soil, light, mechanical energy, altitude, civil-

ization. Methods of plant distribution. Barriers against distribution. Elasticity and non-elasticity in plants. Places of origin of familiar plant forms. Cosmopolitan and local plants.

41. Morphological Botany. Comparative anatomy and histology of plants, especially of phanerogams. General Organography in plants. Metamorphosis of organs. Monstrosities and pathological structures. Evolutionary Organography.

42. Economical Botany. Advanced study and original research along the lines of the subjects of Applied Botany given in the regular college course. One or more themes belonging to this phase of the science will be assigned to each student, as food, textile, architectural products of the plant world, their characteristics, their source, etc.; Materia medica; plants of beneficial or detrimental sanitary importance, etc., etc.

CHEMISTRY.

Charles E. Munroe, Ph.D. .... *Professor*
Frank Wigglesworth Clarke, Sc.D. ... *Professor of Mineral Chemistry*
Harvey W. Wiley, Ph.D., M.D. ... *Professor of Agricultural Chemistry*
Edward G. Seibert, M.D. .... *Assistant Professor*
N. Monroe Hopkins, Ph.D. .... *Assistant Professor*
Edwin A. Hill, Ph.D. .... *Assistant Professor*
Thomas M. Price, Ph.D. .... *Assistant Professor*
Otis D. Swett, B.S. .... *Instructor*
Elmer S. Newton, B.A., M.D. .... *Instructor*
Arthur N. Tasker, B.A. .... *Assistant*
Ernest W. Brown, Ph.D. .... *Assistant*
Raymond Outwater, M.S. .... *Assistant in Assaying*
William E. Hillyer, M.S. .... *Assistant*
Edwin Smith, Jr. .... *Assistant*

First Section. Primarily for Undergraduates.

1. General Chemistry. A series of illustrated lectures, accompanied by recitations and exercises, on theoretical, inorganic, organic, and technical chemistry. *Tu., Th., Sat.*, at 4.50. Professor Munroe, Mr. Swett.

2. Laboratory Practice. A laboratory course for the study of the principles of chemistry and the methods of conducting chemical experiments. Two three-hour periods. *Tu., Th.*, at 1.30. Professor Munroe, Asst. Professor Hopkins, Dr. Hill, Mr. Smith, Mr. Hillyer.

3. Preparation and Study of the Properties of Chemical Substances. A laboratory course. Two three-hour periods. *Tu., Th.,* at 1.30. Professor MUNROE, Dr. PRICE, Mr. SMITH, Mr. HILLYER.

4. Assaying and Metallurgy of the Precious Metals, carried on by the methods used by the Government assayers, the laboratory being fitted up on the plan of that of the United States Mint. Twelve hours, for three months. Professor MUNROE, Mr. OUTWATER.

5. Lectures on the Principles of Analysis. One hour. Professor MUNROE.

6. Metallurgy of Iron and Steel. A course of lectures and readings. *Tu.,* at 5.40. Professor MUNROE.

7. Qualitative Analysis. A brief course intended primarily for students in engineering. Two three-hour periods. Professor MUNROE, Dr. PRICE, Mr. SMITH.

Second Section. For Undergraduates and Graduates.

20. Qualitative Analysis. A laboratory course in the study of the properties and reactions of chemical substances, and of the means employed for their detection and identification. Three three-hour periods. Professor MUNROE, Dr. PRICE, Mr. SMITH.

21. Quantitative Analysis. A laboratory course in the quantitative estimation of the constituents of a specially selected and typical set of chemical substances, which are particularly adapted for teaching the student the aims and methods of quantitative chemical analysis and for imparting facility in manipulation. Four three-hour periods. Professor MUNROE, Dr. PRICE.

22. Technical Analysis and Industrial Processes. A lecture and laboratory course in which the elements of chemical engineering are taught, and special attention is given to rapid commercial methods of analysis. Four three-hour periods. Professor MUNROE.

23. Advanced course in Organic Chemistry. *Wed., Fri.,* at 4.50. Professor MUNROE, Mr. SWETT.

24. Advanced course in Organic Chemistry. A continuation of Course 23. *Th., Sat.,* at 5.40. Professor MUNROE, Mr. SWETT.

25. Chemistry of the Carbon Compounds. A laboratory course in the preparation and study of the properties of a characteristic series of organic compounds. Four three-hour periods. Professor MUNROE, Dr. PRICE, Mr. SWETT.

26. Physical Chemistry. A lecture course designed to be an introduction to physical chemistry, and to treat of the modern theories of chemistry from the physical standpoint. In this course special attention is given to the subject of electro-chemistry. *Mon., Wed.*, at 5.40. Asst. Professor HOPKINS.

27. Stereo-chemistry. This course deals with the arrangements of atoms in space from a theoretical standpoint, while the student is taught how to form models by which to illustrate their arrangements. Two hours. Asst. Professor HILL.

28. Biochemistry. A laboratory course in the chemical examination of some of the chief foodstuffs, the tissues and fluids of the body, and the products of certain organisms; also the isolation of the digestive enzymes and a study of their action *in vitro*. Three three-hour periods. Asst. Professor PRICE.

29. Organic Chemistry. Especially designed for students in medicine and dentistry. Two hours for one term. Professor MUNROE.

30. Physiological Chemistry. A series of lectures and recitations on the proximate principles of the human body. Two hours for one term. Assistant Professor SEIBERT.

31. Clinical Analysis. A laboratory course to accompany 30. Professor MUNROE, Assistant Professor SEIBERT, Mr. TASKER, and Dr. BROWN.

34. Volumetric Analysis. Especially designed for students in medicine. Professor MUNROE and Dr. NEWTON.

Third Section. Primarily for Graduates.

40. Explosive Substances. Professor MUNROE.

41. Analytical Methods. Professor MUNROE.

42. The Phenomena of Deliquescence and Efflorescence. Professor MUNROE.

43. Development of the Theory of the Constitution of the Natural Silicates. Professor CLARKE.

44. The Redetermination of Atomic Weights. Professor CLARKE.

45. Special Researches in Agricultural Chemistry. Professor WILEY.

46. Special Researches in Electro-chemistry. Assistant Professor HOPKINS.

Students in Chemistry are invited to attend the meetings of the Chemical Society of Washington. These meetings are held on the second Thursday of each month from October to May, in the Assembly Hall of the Cosmos Club, at 8 p. m.

CIVIL ENGINEERING.

Henry A. Pressey, Ph.D. .... *Professor*
Edwin V. Dunstan, B.S. .... *Instructor*
Arthur B. Ilsley, B.S. .... *Instructor*

First Section. Primarily for Undergraduates.

1. Surveying and Mapping. This course includes the theory and use of instruments; land, topographic, hydrographic, mining, city, and geodetic surveying; measurement of volumes; projection of maps, etc. Text-book, Johnson's Surveying. *Tu., Th.*, at 2.30. Field work, not less than 60 hours during the session, usually on Saturday morning.

2. Railroad Engineering. Railroad curves and earthwork; location of about two miles of railroad, including reconnaissance, preliminary and final locations, construction of contour maps and profiles, computation of earthwork, design of culverts, etc.; laying out curves; track work, etc. *Tu., Th.*, at 4.50. Field work not less than 60 hours during the session.

3. Highways and Pavements. Location of highways; construction, improvement and maintenance of roads and pavements; curbs, gutters, sidewalks; specifications and contracts; reports, estimates, etc. *Tu., Th.*, at 9.30, one term. Field work and drawing, three hours per week for one term, *Tu.*, 10.30 to 12.30, and an additional hour to be assigned

4. Materials of Construction. A study of the properties of stone, brick, cement, concrete, wood, iron, steel, etc., including the inspection of and specification writing for these materials; also the elements of building construction, brick and stone work, carpentry, roofing, etc. First term, *Wed., Fri.*, at 5.40; second term, *Wed.*, at 5.40, and three hours in drawing-room and laboratory to assigned.

5. Water-Works. Study of the design, construction and maintenance of water-works systems, with especial attention to purification of water; quantity and quality; rainfall, run-off and evaporation; impurities, bacteria, organic matter; chemical and bacterial examinations; ground water, springs, wells, infiltration galleries; reservoirs and standpipes; distributing systems; fire protection; hydrants; pumps; filters and filtration; construction; specifications, contracts, estimates. Second term, *Mon.*, at 10.30; *Wed.*, at 10; *Fri.*, at 10.30; design, *Tu.*, 10.30 to 12.30.

6. Sewerage. A study of the design, construction, and maintenance of sewerage systems, with special reference to sewage disposal; combined and separate systems; amount of sewage, rainfall, and run-off; flow in sewers; flushing and ventilation; location and grades; specifications, contracts and estimates; practical sewer construction. First term, *Tu., Th.,* at 1.30; design, *Th.,* 10.30 to 12.30.

7. Engineering Testing. Tests upon engineering materials, iron, wood, masonry, etc.; Stresses of framed trusses.

There are six laboratory exercises of two hours each in connection with the course in theoretical hydraulics.

Tests are made of pumps, water-wheels, etc., and measurements of the flow of water by means of weirs, meters, nozzles, and orifices. Three hours a week for one term.

Second Section. For Undergraduates and Graduates.

20. Masonry Construction. Engineering materials; cement; brick; stone, etc. Tests and specifications; foundations; pile driving; bridge piers and abutments; masonry dams and retaining walls; arches and culverts; designs and estimates. *Mon., Fri.,* at 5.40; design, *Fri.,* 10.30 to 12.30.

21. Hydraulic Engineering. The design and construction of water-power plants and irrigation works. Flow of rivers; rainfall; run-off; methods of development; backwater; dams; canals; headworks; gates; water-wheels; power-house; power transmission. Irrigation plans; distributing systems; duty of water; water-rights and irrigation law. *Tu., Wed., Th.,* at 1.30; design, *Th.,* 10.30 to 12.30, for one term.

22. Framed Structures. Principles and practice of design. Laws of equilibrium; loads; reactions, shears, and moments in beams; computation of stresses; plate girders; roof trusses; highway and railroad bridges; working plans; details of construction; shop practice; specifications and contracts; bills of material. Designs are made for a roof truss and three bridges. *Tu., Th., Sat.,* at 5.40; design, four hours per week.

Third Section. Primarily for Graduates.

40. Water Supply. Details of water-works. Study of surface and underground waters as sources of supply, with special reference to methods of purification. Professor Pressey.

41. Sewerage. Details of sewerage systems, with special reference to methods of sewage disposal. Professor Pressey.

42. Hydrology. Flow of rivers, rainfall, and the effects of topography, forests, etc., upon the run-off of watersheds. Professor Pressey.

43. Irrigation. Professor Pressey.

44. Advanced course in the graphic statics of building construction.

45. The theory of suspension, continuous, cantilever, and braced arched bridges, with a more complete course in the design of plate girders, riveted and pin-connected bridges, with working drawings and estimates.

46. Advanced course in construction. The theory and designing of retaining walls, masonry arches, and dams.

47. Thesis, the subject of which is to be selected by the student and approved by the Professor of Civil Engineering.

CLASSICAL LANGUAGES AND LITERATURES.

Mitchell Carroll, M.A., Ph.D. .... *Professor*
Charles Sidney Smith, A.M. .... *Assistant Professor*
Ashton Waugh Macwhorter, Ph.D. .... *Instructor*
Paul Noble Peck, A.B. .... *Instructor*

GREEK.

First Section. Primarily for Undergraduates.

1. Lysias (selected orations); Herodotus (selections); Euripides (Alcestis, Medea); Greek prose composition. *Mon., Wed., Fri.,* at 2.30. Asst. Professor Smith. (Dr. Macwhorter, 1905-06.)

2. Thucydides (Book VII); Sophocles (Antigone); Xenophon (Memorabilia). *Mon.,* at 11.30; *Wed.,* at 11; *Fri.,* at 11.30. Professor Carroll and Dr. Macwhorter.

3. Elementary Course. For students who have not taken Greek before matriculating. It aims to cover as much as possible of the entrance requirements in Greek. With private study during the summer the student may be able to take up Course 1 at the beginning of the following year with condition on Homer. Three hours. Mr. Peck.

Second Section. For Undergraduates and Graduates.

20. Plato (selections); Aristophanes (Clouds); Aeschylus (Seven against Thebes, Prometheus). *Tu., Th.,* at 9.30. Given in 1906-07. Professor Carroll.

21. Greek Literary Criticism: Aristotle (Art of Poetry); Aristophanes (Frogs); Greek Lyric Poetry (selections); Conferences on History of Greek Literature. *Tu., Th.*, at 9.30. Not given in 1906–07. Given in 1907–08.

22. Greek Prose Composition (advanced course): Practical exercises in syntax and translation. *Th.*, at 11.30. Dr. MACWHORTER.

23. Homer: Rapid reading of the Odyssey. One hour. *Fri.*, at 4.50. Asst. Professor SMITH.

LATIN.

First Section. Primarily for Undergraduates.

1. Livy (Books I, XXI); Cicero (De Senectute); Horace (Odes and Epodes); Latin prose composition. *Mon., Wed., Fri.*, at 1.30. Asst. Professor SMITH (Dr. MACWHORTER, 1905-06).

2. Cicero and Pliny (selected letters); Satires and Epistles of Horace; Ovid (selections); Martial (selections). *Mon., Wed., Fri.*, at 3.30. Professor CARROLL and Asst. Professor SMITH (Dr. MACWHORTER, 1905-06).

Second Section. For Undergraduates and Graduates.

20. Tacitus (selections); Vergil (Bucolics); Lucretius, *Tu., Th.*, at 10.30. Professor CARROLL.

21. Roman Literary Criticism: Quintilian (Book X) and Horace (Ars Poetica); Catullus, Tibullus, and Propertius; Conferences on History of Roman Literature. *Tu., Th.*, at 10.30. Not given in 1906-07. Given in 1907-08.

22. Latin Composition and Reading at Sight: Practice in Latin expression and style. *Tu.*, at 1.30. Asst. Professor SMITH.

23. Plautus and Terence. *Th.*, at 1.30. Asst. Professor SMITH.

NOTE.—Students in Greek and Latin are recommended to take as electives the following courses in Classical Archæology:

20. Topography and Monuments of (*a*) Athens and (*b*) Rome. *Mon., Th.*, at 4.50. Professor CARROLL.

21. Private and Public Life of the Greeks and Romans. Given in 1905-06. *Mon., Th.*, at 4.50.

22. Greek and Roman Architecture and Sculpture. Not given in 1906-07. Given in 1907-08.

Third Section. Primarily for Graduates.

THE SEMINARY OF CLASSICAL PHILOLOGY.

Professor CARROLL .... *Director*

The design of the Seminary of Classical Philology is to afford discipline in the methods of philological criticism and research with especial reference to the interpretation of classical authors. It is composed of all graduate students in Classical Languages, and is under the supervision of the Director, who is assisted by the other instructors of the department in certain features of the work. Each year two authors in related branches of Greek and Latin literature are made the centre of study. Interpretations of the texts under consideration are prepared by the members, and papers are read by them containing the results of special study of philological or literary topics. Wide and systematic reading in the authors selected is carried on under personal supervision, and special lectures are given on the departments of literature involved. The authors selected for criticism and interpretation are as follows:

1904-05. Greek, 41, Thucydides; Latin, 41, Tacitus.
1905-06. Greek, 42, Homer; Latin, 42, Vergil.
1906-07. Greek, 43, Attic Orators; Latin, 43, Cicero.
1907-08. Greek, 40, Aristophanes; Latin, 40, Plautus.

Regular meetings of the Seminary are held on *Tu., Wed.,* at 4.50.

SCHOOL OF CLASSICAL STUDIES AT ATHENS.—The University, through friends, is a contributor to the support of the American School of Classical Studies at Athens, and graduates of this University are entitled to all its advantages without expense for tuition.

THE CLASSICAL CLUB.

The Classical Club, which is composed of instructors and advanced students in Greek and Latin and Classical Archæology, meets monthly for the more detailed discussion of special topics in ancient life, literature, and art than is ordinarily possible in the class-room. At each meeting a paper is read, reviews of recent classical publications are presented, and reports are made from various sites of archæological excavation. Teachers and patrons of the classics in Washington are admitted as associate members, and at open meetings the club avails itself, when possible, of the services of eminent scholars from other universities who may be temporarily in the city.

Students in classical languages and members of the Classical Club are invited to attend the public lectures of the Washington Society of the Archæological Institute of America, which are held usually in University Hall.

ECONOMICS AND SOCIOLOGY.

C. William A. Veditz, Ph.D., LL.B. .... *Professor of Economics*
Henry Parker Willis, Ph.D. .... *Professor of Finance*
Oscar P. Austin .... *Professor of Commercial Geography*
Carroll D. Wright, LL.D. .... *Lecturer*

ECONOMICS.

First Section. Primarily for Undergraduates.

1. Elementary Economics. Introduction to the study of political economy, beginning with a brief sketch of the rise and development of the science and an outline of the industrial evolution of the United States. The principal topics under discussion are the nature and scope of economics, the present-day schools of economic doctrine, the problems of methodology, the nature of human wants, economic laws, the concept of value, the determination of prices, the factors and methods of production, the exchange of products. Although this is essentially a course in economic theory, the student is led to observe the phenomena of every-day industrial life; and visits are made by the class to factories and other industrial establishments in the vicinity of Washington. Text-book, Gide's "Principles of Political Economy," adapted by Veditz. The text-book is supplemented by lectures, assigned reading from the classical economists and typical modern authorities, class-room discussions, and reports on assigned topics by members of the class. First half-year, *Mon.*, *Wed.*, and *Fri.*, at 3.30. Professor Veditz.

2. The Economics of Distribution and Consumption. A continuation of Course 1, employing the same methods of instruction. This course, however, places emphasis upon the problems that center about the division of the social product,—the problems of rent, interest, wages and profit. It includes also an examination, historical, descriptive and analytical, of Competition, Private Property, and *Laissez faire*, from the standpoint of public welfare; and some study of those quasi-ethical problems that belong partly to the field of economics,—Luxury, Saving, Spending, and Speculation. Second half-year, *Mon.*, *Wed.*, and *Fri.*, at 3.30. Professor Veditz.

3. Money and Banking. During the first half-year this course is devoted to a discussion of the history and theory of money. Some of the chief topics covered are the monetary history of the United States, the conditions of production of the precious metals, the theory of prices and mode of measuring price fluctuations, bimetallism, token money, and the relation of the Treasury system of the United States to our money supply. Special attention is given to international exchange and the movement of the precious metals between countries. General reference is made to foreign monetary systems, but the course deals primarily, on its practical side, with monetary conditions in the United States. In the second half-year the course deals with the theory of credit and banking. Particular attention is paid to the national-bank act and its relation to the financial system of the United States. The principal banking systems of foreign countries are compared with our own, and the probable lines of change to be followed in the immediate future are indicated. During the latter part of the course a review of banking practice is undertaken. *Wed., Sat.,* at 5.40. Professor WILLIS.

Second Section. For Undergraduates and Graduates.

20. Industrial Evolution. This course is designed to furnish a general survey of the development of society from an economic point of view, and more particularly to discover the forces which have given rise to modern capitalism and large-scale methods of production. It is at the same time a systematic attempt at the economic interpretation of history. While the principal emphasis is placed upon facts and the necessity for critical methods in the employment of those facts, some time is nevertheless devoted to an examination of the more familiar generalizations which have been made regarding economic evolution,—such as those of Hildebrand, Buecher and Karl Marx. First half-year, *Mon., Wed.,* at 4.50. Professor VEDITZ.

21. Socialism and Social Reform. The course begins with a history of communistic schemes, particularly so-called "Utopian" socialism as advocated by Plato, Thomas More, Saint Simon, Fourier, and Owen. This is followed by an examination of modern collectivism as presented by Rodbertus, Karl Marx, Lassalle and Bernstein. The course concludes with an examination of the single-tax doctrine of Henry George, of schemes of profit-sharing between employer and employees, and of co-operation. Second half-year, *Mon., Wed.,* at 4.50. Professor VEDITZ. (In alternate years; not given in 1906-07).

22. Public Finance. The foundation of this course is a study of the modern budget with special reference to the United States. This is followed by an analysis of the theory of taxation, its shifting and incidence. The principles worked out in these earlier portions of the inquiry are applied to the internal revenue and tariff systms of the United States. Part of the course deals with methods of state finance as observed in the commonwealths of the United States.

The second half-year is spent chiefly in the study of municipal accounting, with special reference to public-service corporations. Introductory to this main topic, the chief theoretical and practical considerations affecting state industrial operation and control are indicated. In general, however, the course is devoted to analyses of actual experience rather than to the vaguer questions of state or municipal ownership. *Tu.*, *Fri.*, at 5.40, in alternate years; not given in 1906-07. Professor WILLIS.

23. Theory and Practice of Statistics. During the first half-year this course presents the elementary principles of statistics, illustrating their application by concrete examples. The graphic method, the use of averages, index numbers, and the special application of statistics to insurance is thoroughly discussed. About one-third of the time is spent in laboratory work designed to give practice in the application of the methods theoretically presented.

During the second half-year the course is devoted to a general survey of economic and social statistics. This includes a review of government statistical methods and publications in the United States and the principal foreign countries.

Two hours. Alternating with Course 22. Given in 1906-07. Professor WILLIS.

24. Corporation Finance. By way of introduction to this subject, a descriptive study of the various kinds of corporation securities is entered upon. From this descriptive outline the discussion leads to methods of organizing and financiering modern industrial enterprises. The method of study is, in part, that of analysis of specific well-known examples of corporate organization. There is also given a brief outline, in the first half-year, of the principles of corporation accounting.

A study of Investment and Speculation occupies the second half-year of the course. This implies a study of stock-exchange speculation, including the organization of our stock exchanges and the financial institutions connected with them. The economic distinction between the idea of investment and that of speculation and the conclusions to which this distinction leads are made clear. Methods of dealing in the chief staple products of the country, the organi-

zation of the industries in which these staples are produced and handled, and the way in which such industries and their products are affected by speculative and investment operations are also considered.

Mon., Th., at 5.40, in alternate years; not given in 1906-07. Professor WILLIS.

25. Accounting. The first half-year's work in Accounting includes a survey of the general principles of the subject and an examination of the more important forms of commercial paper and business methods. A text-book on accounting and hand-books of business forms are used as guides. In the second half-year the accounts of representative kinds of businesses are studied, and the methods of accounting and auditing applicable thereto are developed. This portion of the work consists partly of lectures and partly of special investigations by members of the class along lines illustrative of the oral discussion in the class-room.

Two hours. Alternating with Course 24. Given in 1906-07. Professor WILLIS.

26. International Trade. This course begins with an outline history of European commerce, including the commercial policies of the principal nations. This is followed by a more detailed history of American commerce with particular attention to the commercial treaties between the United States and foreign countries. The course also includes an examination of the organization of the ocean carrying trade and the leading continental trade routes, and terminates with a comparative study of modern commercial policies with particular emphasis upon the expansion of American trade in foreign markets.

First half-year. *Tu., Th.*, at 5.40. Professor VEDITZ.

27. Labor Legislation. The purpose of this course is to afford a general view of the relations of the government, both in this country and abroad, to labor interests and to the labor problems that grow out of modern productive methods. It includes a sketch of the rise of these problems and an examination of such subjects as: child labor; dangerous occupations; immigration as it affects labor; workingmen's insurance against sickness, old age, accidents, and loss of work; labor organizations; strikes and industrial conflicts; conciliation and arbitration; collective bargaining. If time permits, a brief history of the labor movement in the United States is undertaken. In alternate years; given in 1906-07. Second half-year; *Mon., Wed.*, at 4.50. Professor VEDITZ.

28. Commercial Geography. Primarily for students in the Department of Politics and Diplomacy; open to advanced students in Arts and Sciences. Two hours. Professor AUSTIN.

SOCIOLOGY.

Second Section. For Undergraduates and Graduates.

20. The Science of Society. A general course in theoretical sociology. The scope of sociology; its relation to the individual social sciences; the organic concept of society; the contract theory and its variants; the fundamental factors of social evolution; the biological, economic, and psychological schools of sociologists; race, environment, and heredity; forms of society; social institutions in their origin and development; social progress. *Tu., Th.*, first half-year, at 4.50. Professor VEDITZ.

21. American Social Problems. A course in practical sociology designed to acquaint the student with the great present-day problems of social life in this country—the treatment of defectives, dependents and delinquents. The principal problems under discussion are immigration, pauperism, unemployment, charity organization and poor relief, slums, intemperance, and criminality.

This course is not technical, but intended as a preparation for intelligent citizenship. Students are encouraged to undertake sociological field-work and to study the charitable and correctional institutions and practices of the District of Columbia. Class visits are made to institutions of this character, and from time to time specialists in social reform work are invited to lecture to the class. *Tu., Th.*, second half-year, at 4.50. Professor VEDITZ.

22. Statistics and Social Economics. Professor WRIGHT.

Third Section. Primarily for Graduates.

40. Criminology and Penology. An advanced course in social philosophy for the consideration of the following subjects: The concept of crime; the necessity of legal compulsion; evolution of the idea of crime; the lex talionis; the nature and purposes of punishment; social defense; the individualization of punishment; capital punishment; duels and ordeals; reformation; the indeterminate sentence; the French *loi Bérenger;* juvenile courts; prison systems; etc. Professor VEDITZ.

41. Seminary in Economics and Sociology. A limited number of students competent to undertake the work are organized into a Seminary for the scientific investigation of important problems in Economics and Sociology. Two hours. Professors VEDITZ and WILLIS.

ELECTRICAL ENGINEERING.

Frank A. Wolff, Ph.D. .... *Professor*
Philander Betts, M.S., E.E. .... *Assistant Professor*
.... *Instructor*

First Section. Primarily for Undergraduates.

1. Elementary Mathematical Theory of Electricity and Magnetism, with special attention to the needs of engineering students. Text-book: Glazebook's "Electricity and Magnetism," supplemented by problems. *Tu., Th., Sat.,* at 4.50, for three months.

2. Direct-current motors and generators. Covers the laws of the magnetic circuit as applied to the dynamo. Students are required to design a direct-current machine. Text-books: Hawkins and Wallis's "The Dynamo." *Tu., Th., Sat.,* at 4.50 ,beginning January 1st.

3. Elements of Electrical Engineering. Text-book: Tyson Sewell's "Elements of Electrical Engineering." *Tu., Th.,* at 11.30.

4. Electrical Measurements. A laboratory course for Juniors. Selected experiments. Foster's hand-book and special laboratory notes are used for reference. Six hours a week, first term. *Tu., Th.,* 1.30 to 4.30.

5. Electrical Laboratory. Experiments and tests involving the operation of direct-current dynamos and motors, including tests of motors in service, operating elevators, street cars, and machinery of various kinds. Text-book: Sever and Townsend's "Laboratory and Factory Tests in Electrical Engineering." Six hours a week, second term. *Tu., Th.,* 1.30 to 4.30.

6. Industrial Electricity. A practical course intended for Juniors in Civil Engineering, embracing the selection and operation of electrical machinery, electric railways and other applications of electric motors. One hour a week.

7. Electrical Engineering. A course in theoretical and applied electricity intended for Seniors in Mechanical Engineering. It embraces the selection and operation of electrical machinery, the location, construction and operation of power plants, electric railways and transmission lines, the use of electric motors for driving machinery, and the working of storage batteries, elevators, hoists and cranes. Three hours a week.

Second Section. For Undergraduates and Graduates.

21. Alternating Current Theory and Machinery. A course for Seniors in Electrical Engineering, covering the principles of single as well as polyphase currents, including study of machines, circuits, transformers, etc. Text-books: Jackson's "Alternating Currents" and Oudin's "Polyphase Apparatus and Systems." *Mon., Tu., Th., Sat.*, at 4.50.

22. Electrical Distribution. A course for Seniors in Electrical Engineering covering the whole field of distribution of electricity for light and power. Text-book: Crocker's "Electric Lighting;" Second volume, "Distribution Systems." *Tu., Th.*, at 5.40.

23. Electrical Applications. A course for Seniors in Electrical Engineering, covering the more important applications of electricity, such as illumination, motive power, signalling, telephony, electrochemistry, etc. *Mon., Wed.*, at 1.30.

24. Advanced Laboratory Work for Seniors in the Electrical Engineering Course. Covers test and experimental work with direct and alternating currents, tests of machines, circuits, transformers, circuits containing inductance and capacity, measurement of power in alternating current circuits, plotting of curves, etc. Text-book: Sever and Townsend's "Laboratory and Factory Tests in Electrical Engineering," with Foster's Electrical Engineer's Hand Book for general reference. *Tu., Th.*, 1.30 to 4.30.

25. Inspection of Plants and Industrial Works. In the vicinity of Washington and Baltimore are a number of modern electric lighting and street railway plants, telephone exchanges, telegraph operating rooms, Government laboratories devoted to special work, etc., which afford students of Electrical Engineering an opportunity to familiarize themselves with nearly all types of apparatus in use. The visits are followed by class discussion based on written descriptions submitted by the students.

Juniors and Seniors in Electrical Engineering are required to attend the monthly meetings of the Washington Branch of the American Institute of Electrical Engineers held at the University.

The students have an "Electrical Club" which holds technical meetings every two weeks, at which subjects of special interest are discussed.

Third Section. Primarily for Graduates.

41. Technical Applications of Electricity. A course of special lectures on the most recent and most important applications of electricity to industrial and scientific use. Two hours.

42. Design of Direct and Alternating Current Machinery. Two hours.

43. Advanced Course in the Mathematical Theory of Alternating Currents. Three hours, first term.

44. Advanced Course in Polyphase Currents. Three hours, second term.

45. Advanced Laboratory Work, Alternating (including Polyphase) Current Apparatus. Six hours per week.

ENGLISH.

William Allen Wilbur, A.M. .... *Professor*
De Witt C. Croissant, A.B. .... *Instructor*

First Section. Primarily for Undergraduates.

1. Rhetoric. A study of the principles of self-expression in writing and speaking presented in three phases, expository in the science of rhetoric, analytical in English literature, and constructive in composition. *Tu., Th., Sat.*, at 10.30. Professor Wilbur, Mr. Croissant.

2. Rhetoric. Parallel with Course 1. *Mon., Wed., Fri.*, at 4.50. Professor Wilbur, Mr. Croissant.

3. Prose. The development of prose from Sir John Mandeville to Robert Louis Stevenson. About twenty representative prose works are studied in chronological order. The aim of the course is to study critically the development of prose in regard to its form. The course is open to students who have passed in 1 or 2. *Mon.*, at 10.30; *Wed.*, at 10; *Fri.*, at 10.30. Mr. Croissant.

5. American Literature. Lectures on the development of the literature. Students taking this course are required to do wide reading, which is discussed by the class. *Mon., Fri.*, at 5.40. Mr. Croissant.

Second Section. For Undergraduates and Graduates.

20. Composition. An advanced course. Theme writing, paragraph making, and studies in criticism. Wendell's English Composition is used as a hand-book. The course is open to students who have passed in Course 1 or 2. *Tu.*, at 1.30. Professor Wilbur.

21. Old English. A beginners' course; the essentials of the grammar and readings from Old English texts. Bright's Reader. *Tu., Th.*, at 2.30. Mr. Croissant.

22. Shakespeare. The Comedies. Given in 1906-07. *Tu., Th.,* at 4.50. Professor WILBUR.

23. Shakespeare. Tragedies and Romances. Given in 1905-06. *Mon., Wed., Fri.,* at 1.30. Professor WILBUR.

Courses 22 and 23 are given in alternate years. The Temple edition of Shakespeare is recommended.

27. The English Novel. Development of the Novel, with critical studies of selected works, including some contemporary fiction. In 1905-06, *Mon., Fri.,* at 5.40. In 1906-07, *Mon., Wed., Fri.,* at 1.30. Professor WILBUR.

30. Middle English. In the first term particular attention is given the grammar; in the second term more attention is given the literature, with wider reading and special reports. Emerson, A Middle English Reader. *Tu., Th.,* at 1.30. Mr. CROISSANT.

34. History of English Literature to 1700.

35. History of English Literature since 1700. Not given in 1906-07.

Courses 34 and 35 are givn in alternate years, and together form a complete history of English Literature. Lectures are given on the development of the literature, and the class is required to read as widely in the literature itself as the time allows. *Tu., Th.,* at 4.50. Mr. CROISSANT.

Third Section. Primarily for Graduates.

40. History of the English Language. This course aims not merely to present the chronological development of the language since the beginning of the Old English period, but principally to serve as an introduction to the comparative grammar of the Germanic group of languages as they are related to English. References are made to Brugmann, Paul, Dieter, and others. A reading knowledge of German is prerequisite. The course is open to those who have passed in Old and Middle English. Mr. CROISSANT.

44. Seminary in English Literature. Subject in 1905-06: The American Short Story. Subject in 1906-07: British Poetry of the Nineteenth Century. Two hours. Professor WILBUR.

52. The Arthurian Legends: Their expression, development, and significance in English literature.

53. English Romanticism, with particular reference to the beginnings of the romantic movement in the eighteenth century.

55. Religious Philosophy in the Poetry of Tennyson.

Other courses may be arranged for competent graduates.

GEOLOGY AND MINERALOGY.

George P. Merrill, Ph.D. . . . . *Professor*
Timothy W. Stanton, Ph.D. . . . . *Assistant Professor*
R. S. Bassler, Ph.D. . . . . *Assistant Professor*

First Section. Primarily for Undergraduates.

1. Mineralogy. Crystallographic, descriptive, and determinative mineralogy. This course is designed with especial reference to minerals as rock constituents or segregated as ore deposits. It includes, therefore, a discussion of not merely the crystallographic and theoretical, but the practical side of the subjects as well. Whenever possible, it should be considered as introductory to the courses in either systematic or economic geology. *Tu., Th.*, at 5.40.

2. Geology. Systematic geology; dynamical, structural, and stratigraphical. The course is designed to form a part of a general-culture course, or a preliminary course for those intending to make a specialty of geology. It includes lectures, recitations, laboratory and field work so far as hours will permit. Paleontology is treated as a branch of geology, having especial reference to stratigraphy and correlation. Text-books: Scott's Introduction to Geology; Merrill's Rocks, Rock Weathering and Soils. *Mon., Fri.*, at 5.40.

Second Section. For Undergraduates and Graduates.

20. Economic Geology. The course consists largely of lectures upon the subjects comprised under: (1) Mineral veins and metalliferous deposits, their mode of occurrence, origin, and classification; (2) the ores of iron, copper, lead, zinc, tin, silver, gold, mercury, antimony, etc.; and (3) the non-metallic minerals, as the coals and hydrocarbon compounds; salts and materials used in chemical manufactures; abrasive, refractory, and fictile materials, pigments, gems, ornamental stones, building stones, limes, cements, and mineral waters. Text-books: Kemp's Ore Deposits of the United States; Merrill's Stones for Building and Decoration, and the Non-metallic Minerals. *Mon., Fri.*, at 4.50.

21. Paleontology. A course in lecture and laboratory work on the biological and geological relations of the more important types of animals and plants, with especial reference to their value in stratigraphic geology. Two hours.

Third Section. Primarily for Graduates.

Advanced study in Geology, both systematic and applied, is arranged to cover two years.

40. Advanced Geology and Paleontology. The student in this first-year course may devote his time largely, if necessary, to perfecting himself in methods; to general work in the laboratory and in the field; to the examination of geological materials, and to familiarizing himself with the literature of the subject. The utility of the various text-books is recognized, but a very large portion of the desired knowledge on any subject must be gained from special memoirs and from the current literature as it appears in numerous periodicals. The various sources of information, the most essential lines of work, as well as the most promising fields of investigation, are from time to time indicated by the instructor.

41. The student is expected to devote himself to some special investigation which shall serve as the subject of his thesis. The course is modified to suit individual cases, in order that the student may be restricted as little as possible in the exercise of personal taste, originality, and capacity for work.

42. Advanced Paleontology and Stratigraphic Geology. A continuation of Course 21. Besides the study of palæontological methods, the student is expected to pursue some specal line of investigation in order to fit himself for original research.

GERMANIC LANGUAGES AND LITERATURES.

Hermann Schoenfeld, Ph.D., LL.D. .... *Professor*
A. F. W. Schmidt, A.M. .... *Instructor*
Otto Louis Veerhoff, A.B. .... *Assistant*

First Section. Primarily for Undergraduates.

1. A preliminary course in grammar, narrative prose, the elements of historical reading, and select poems of the principal modern poets. Special stress is laid on exercises in composition. One classic (Schiller) is studied. The work done is equivalent to a two years' course in high schools or academies of good standing. Open to students who have not presented German for admission. *Tu., Th., Sat.*, 11.30. Professor Schoenfeld and Mr. Veerhoff.

2. Identical with Course 1, with the addition of material tending to train students in the sciences. *Tu., Th., Sat.*, at 4.50. Professor Schoenfeld and Mr. Schmidt.

3. The deeper aspects of grammar; accurate training in phonetics and translation into German; conversation; readings from the best German prosaists and poets; selected texts from Schiller, Lessing, Goethe, Freytag, and the foremost recent authors. Beginnings of German literature and history. Special preparation for scientific professional work. Open to students who have passed Course 1 or 2, or have fulfilled the entrance requirement in Elementary German. *Mon., Wed., Fri.*, at 3.30. Professor SCHOENFELD.

4. Identical with Course 3. *Tu., Th., Sat.*, at 5.40. Professor SCHOENFELD and Mr SCHMIDT.

5. Advanced course in German syntax; principal difficulties of the language; idioms; synonyms; extensive translaton of the best English prosaists into German; essays; selected advanced prose; classical reading and literature; German history. Special training for advanced students in the historical and economic departments. Open to students who have passed Course 3 or have fulfilled the entrance requirements in Advanced German. *Mon., Wed., Fri.*, at 1.30. Professor SCHOENFELD.

Second Section. For Undergraduates and Graduates.

20. German Literature in the first half of the nineteenth century; its social and political aspects; special study of Kleist, Uhland, Heine; the Romantic School; classicism till Goethe's death; essays, lectures, and collateral reading. *Tu., Th.*, at 10.30. Professor SCHOENFELD.

21. German Literature of the Classic Period at its zenith; Goethe's and Winckelmann's influence on German art; Modern German drama; Hebbel, Ludwig, Freytag, Heyse, Sudermann, Fulda, Hauptmann. *Mon.*, at 10.30; *Wed.*, at 10; *Fri.*, at 10.30. Professor SCHOENFELD.

The intervening periods of Modern German Literature will be studied during the subsequent academic year.

Third Section. Primarily for Graduates.

40. German Literature in the sixteenth century. Braune's Neudrucke Deutscher Literaturwerke. Humanism and Reformation, with special reference to Italian and French influences and their historical basis. Original readings from the Humanists, Hans Sachs, Fischart, and Luther's works. The reformatory projects of Cardinal Nicolaus Cusanus and of Erasmus, Hutten, and Reuchlin. Two hours. Professor SCHOENFELD.

41. German Literature in the twelfth and thirteenth centuries, with special regard to the Nibelungen lay, the Gudrun saga, Wolfram von Eschenbach. The lyrics of Walther von der Vogelweide. The grammatical aspects of the classics of the first period of bloom. Two hours. Professor SCHOENFELD.

The other phases of older German literature and philology will be studied in subsequent years, so that the general range of the history of German Literature may be covered every three years.

45. The emerging of the Germanic, Romance, and Slavic races in European History. The Migration of Peoples. The Evolution of European States to the rise of the Hapsburg House. Cultural elements influencing the three predominating races of Europe. (Selections from the historical sources are read and interpreted.) Professor SCHOENFELD.

46. The Annihilation and Reconstruction of Prussia (Historical and literary sources will be searched). The Building up of the Modern German Empire (Archival studies, literary social forces, Bismarck's literary work). Professor SCHOENFELD.

47. Gothic. Gothic Grammar and translation of select passages from Wulfila. Mr. SCHMIDT.

The aim of this course and the one following is to give the student an insight not only into the development of the German language, but also into the principles of Germanic philology.

48. Old High German. Old High German Grammar and translation of select passages in prose and verse. This course alternates with the one in Gothic. Not given in 1906-07. Given in 1907-08. Mr. SCHMIDT.

For notice of the Richard Heinzel Germanic library, see page 134.

GRAPHICS.

EDWARD ADAMS MUIR, B.S. .... *Assistant Professor*
ISAAC ALLISON, B.S., E.E. .... *Instructor*
EDWIN V. DUNSTAN, B.S. .... *Instructor*

First Section. Primarily for Undergraduates.

1. Mechanical Drawing and Lettering. A study of geometrical and graphical constructions, including higher curves; orthographic and isometric projections; sections and intersections; dimensioning and conventional symbols; principles of working drawings, simple machine details, tracings, and blue prints; lettering as applied to mechanical, topographic, and architectural drawing. Six hours per week in the drawing-room. First section, *Mon.*, *Wed.*, 1.30 to 4.30; second section, *Tu.*, *Th.*, 4.50 to 6.30, and a third period to be assigned.

2. Advanced Mechanical Drawing. A course in working drawings especially designed for Electrical and Mechanical Engineering students. Drawing-room rules and practice; conventional forms and standards; arrangement of views and sections; freehand shop-sketches; detailing from sketches, models and general drawings; proportioning by empirical formulæ. Every effort is made to develop distinctness in delineation, accuracy in dimensions and professional style and finish in each drawing. Six hours a week in the drawing room. *Tu.*, *Th.*, 4.50 to 6.30, and a third period to be assigned.

8. Descriptive Geometry. A study of the representation of lines, surfaces, and solids, and of their relations; tangencies, intersections, and developments; warped surfaces; shades and shadows; original construction problems. *Mon.*, *Fri.*, at 5.40; drawing, *Fri.*, 10.30 to 1.30.

10. Topographic Drawing. A general course, including hypsographic expressions, topographic, cadastral, and public culture symbols; scales and plotting; projections, reductions, and enlargements; compilation, plain and in color. *Mon.*, 10.30 to 12.30.

Second Section. For Undergraduates and Graduates.

20. Graphic Statics. Principles and methods, including the construction and use of the force and equilibrium polygons; dead, live, snow and wind loads; the graphic analysis of beams, girders, roof and bridge trusses; masonry and three-hinged arches, construction of strain sheets, etc. *Tu.*, *Th.*, at 5.40; drawing and design, *Fri.*, 1.30 to 3.30.

GREEK.

(See statement under Classical Languages and Literatures.)

HISTOLOGY.

John B. Nichols, M.D. .... *Professor*
D. Webster Prentiss, M.D. .... *Assistant Professor*
Henry M. Jewett, M.D. .... *Assistant Instructor*
C. L. Davis, M.D. .... *Assistant Instructor*

Second Section. For Undergraduates and Graduates.

20. The minute structure of the tissues and organs of the body is presented in a systematic course of lectures illustrated by specimens thrown on the screen by means of the projection microscope. Subsequently the same structures are studied under the microscope.

Practical instruction is given in microscopical technique and in the care and manipulation of the microscope and the preparation of specimens. Primarily for students of medicine; open to advanced students in Arts and Sciences. First half-year, *Mon., Wed., Fri.,* 4.50 to 6.30.

HISTORY.

Charles Clinton Swisher, Ph. D., LL.D. .... *Professor*
William Hamilton, Ph.D. .... *Lecturer*
L. Russell Alden, A.M. .... *Instructor*
Edward M. Dawson, Jr., B.S. .... *Instructor*
Walter Farleigh Dodd, Ph.D. .... *Instructor*

First Section. Primarily for Undergraduates.

1. Mediæval History. Beginning with a comprehensive survey of those conditions of ancient civilization which have been most potent in their influence upon later times, this course treats in detail the migration and settlement of the Germanic tribes in the territory of the Empire, and the gradual blending of Roman and Teutonic institutions into the modern state. Text-books, lectures, and collateral reading. *Mon., Wed., Fri.,* at 2.30. Mr. Alden.

2. Modern European History. A history of the European states, under the new conditions brought into existence by the Protestant Revolution, the invention of printing, and the discovery of America, to the period of the French Revolution. Text-books, lectures and reports. *Tu., Th., Sat.,* at 11.30. Mr. Alden.

3. English Constitutional History. A history of the evolution of parliamentary government, with incidental study of social and industrial development extending through the revolutionary settlement of 1689. Lectures, text-book and collateral readings. *Mon., Wed.,* at 4.50. Professor Swisher and Mr. Dawson.

Second Section. For Undergraduates and Graduates.

20. European History During the Revolutionary Period. The political significance of the Revolution of 1789, the career of Napoleon, and the subsequent progress toward constitutional government on the continent of Europe through the revolutionary movement of 1848. Lectures, text-books and examinations, with the assignment of special subjects for investigation and report. *Tu., Th.,* at 4.50. Professor Swisher and Dr. Hamilton.

21. Contemporaneous History. The realization of the movements toward national unity in Germany and Italy, with a discussion of

the resulting conditions in their relation to international politics. Lectures and examinations, with the assignment of special subjects for investigation and report. Open to students who have completed courses 1, 2, and 20. *Wed., Fri.,* at 2.30. Professor SWISHER and Dr. HAMILTON.

22. European Diplomatic History. A general history of the international relations of the European states from the treaties of Westphalia, with special discussion of some of the more recent treaties. Lectures, examinations and collateral reading. Open to students who have completed courses 20 and 21. *Wed., Fri.,* at 5.40. Professor SWISHER.

23. English Constitutional History since the Revolution of 1688; the beginnings of party government, the conflict between the Crown and the Whig oligarchy, and the reform movements of the nineteenth century. Examinations and collateral readings. Open to students who have completed course 3. *Tu., Th.,* at 2.30. Professor SWISHER and Mr. ALDEN.

24. The History of the British Empire. A study of the English foreign policy in early times; colonial expansion in the sixteenth, seventeenth, and eighteenth centuries; the establishment of protectorates and spheres of influence in the nineteenth, with incidental reference to the problems of imperial federation. Open to students who have completed the work in Mediæval, Modern European, and English History. Lectures, examinations, and collateral reading. *Tu., Th.,* at 3.30. Professor SWISHER and Mr. ALDEN.

25. American Colonial History. A study of the economic, political, and social conditions of the English colonies which led to the Revolution of 1776, and the movement toward national union. Lectures, text-books and collateral reading. *Mon., Fri.,* at 4.50. Dr. DODD.

26. American Constitutional History. The origin and development of the Federal Constitution of 1789, with a comprehensive study of its interpretation under the pressure of party issues extending through the periods of division and reunion. Lectures, text-books, and collateral reading. *Mon., Fri.,* at 4.50. Professor SWISHER.

27. American Industrial History. An economic interpretation of some of the more distinctive phases of American politics. Open to students who have completed courses 25 and 26. Two hours. *Tu., Th.,* at 4.50. Professor SWISHER.

28. Party Government in the United States. A study of the issues upon which parties are founded, with an examination into party methods as illustrated in political platforms, primaries, nominating

conventions, and campaign literature. Open to students who have taken courses 25 and 26. Two hours. *Wed., Fri.*, at 1.30. Professor SWISHER.

29. The Spanish Colonies in America. A study of the Spanish colonial policy as illustrated in the growth and subsequent independence of Mexico and the South American states. Lectures and examinations. Two hours. *Mon.*, at 9.30; *Wed.*, at 9.00. Professor SWISHER.

30. Current History. A discussion of political questions of the present time with special reference to their origin and historical significance. One hour. Lectures and examinations. *Wed.*, at 11.00. Professor SWISHER.

Third Section. Primarily for Graduates.

40. A discussion of the sciences auxiliary to historical study, of historical materials, and of the methods employed in the investigation, presentation and general treatment of historical evidence. The course is intended primarily as an object lesson in the principles of historical criticism, for the assistance of graduate students in the preparation of theses. Professor SWISHER.

41. American Constitutional History, 1776 to 1789. A history of the origin and formation of the Federal Constitution. Professor SWISHER and Dr. DODD.

42. The Slave System in American Politics. A study of parties and party issues from the period of the Missouri Compromise to the formation of the Republican Party. Professor SWISHER.

43. American History from 1860 to 1883. A constitutional study of the period of Civil War and Reconstruction. Professor SWISHER.

44. English Constitutional History from 1603 to 1689. A study of the constitutional issues between Crown and Parliament under the Stuarts through the Revolution of 1689. Professor SWISHER and Mr. ALDEN.

45. English History from 1783 to 1885. A history of the reform movement in England from the close of the American Revolution through the second ministry of Gladstone. Professor SWISHER and Mr. ALDEN.

46. The History of France from 1789 to 1804. Constitutional development in France from the meeting of the States General to the beginning of the First Empire. Dr. HAMILTON.

Work in seminaries. The results of individual research upon assigned topics, and reviews of recent political and historical publications by graduate students will be discussed at the weekly meetings of the seminaries of history.

HYDRAULIC ENGINEERING.

HENRY L. ABBOT, LL.D. .... *Professor*

Third Section. Primarily for Graduates.

40. Laws of flowing water, in natural channels, in pipes, and over weirs, with modes of measurement.

41. Underground flow as sources of supply, with modes of estimation.

42. Relation of rainfall to run-off.

43. Regulation of river flow for purposes of navigation, and for protection against inundation.

44. Slack-water navigation, including dams, canal locks, and waste weirs.

45. Earth dams and river embankments, theory and modes of construction.

45. Effect of forests upon water supply.

HYGIENE.

W. F .R. PHILLIPS, M.D. .... *Professor*

Second Section. For Undergraduates and Graduates.

20. The course in Hygiene is devoted to teaching the relations of habits and surroundings to health. Consideration is given to domestic and municipal sanitation and to the principles underlying legislative interference in matters of public health. Primarily for students of medicine; open to advanced students in Arts and Sciences. Second half-year. *Tu.*, at 8 a. m.

ITALIAN.

(See statement under Romance Languages and Literatures.)

LATIN.

(See statement under Classical Languages and Literatures.)

MATHEMATICS.

James Howard Gore, Ph.D. . . . . *Professor*
Paul Noble Peck, A.M. . . . . *Instructor*

First Section. Primarily for Undergraduates.

2. Plane and Solid Geometry; Gore's Plane and Solid Geometry. *Tu., Th.*, at 5.40. Mr. Peck.

3. Solid Geometry; Gore's Plane and Solid Geometry. *Mon.*, at 9.30; *Wed.*, at 9; *Fri.*, at 9.30, October and November. Mr. Peck.

4. Algebra; Bowser's College Algebra. *Mon., Wed.*, at 4.50. Mr. Peck.

5. Algebra; Bowser's College Algebra. *Mon.*, at 9.30; *Wed.*, at 9; *Fri.*, at 9.30, December to March. Mr. Peck.

6. Solid Geometry; Gore's Plane and Solid Geometry. *Tu., Th., Sat.*, at 4.50, October and November. Mr. Peck.

7. Plane Trigonometry; Wells' Plane and Spherical Trigonometry. *Mon.*, at 9.30; *Wed.*, at 9; *Fri.*, at 9.30, April and May. Mr. Peck.

8. Algebra; Bowser's College Algebra. *Tu., Th., Sat.*, at 4.50, December to March. Mr. Peck.

9. Spherical Trigonometry; Wells' Plane and Spherical Trigonometry. *Mon.*, at 11.30; *Wed.*, at 11; *Fri.*, at 11.30; October and November. Professor Gore.

10. Plane Trigonometry; Wells' Plane and Spherical Trigonometry. *Tu., Th., Sat.*, at 4.50, April and May. Mr. Peck.

11. Analytic Geometry; Smith and Gale's Analytic Geometry. *Mon.*, at 11.30; *Wed.*, at 11; *Fri.*, at 11.30, December to May. Professor Gore.

12. Spherical Trigonometry; Wells' Plane and Spherical Trigonometry. *Mon., Wed., Fri.*, at 5.40, October and November. Mr. Peck.

14. Analytic Geometry; Plane and Solid; Smith and Gale's Analytic Geometry. *Mon., Wed., Fri.*, at 5.40, December to May. Mr. Peck.

Note.—Courses 2 and 4 are intended for students who desire to review some parts of elementary algebra and plane geometry, in

order to obtain that thorough and ready knowledge of these fundamental mathematical studies that is necessary for their proper use in other subjects. These classes are not intended for beginners, and only students who have studied elementary algebra and plane geometry are admitted.

Courses 3, 5, and 7 are designed to occupy one year; likewise Courses 2 and 4.

Engineering students whose time will permit are advised to complete during their first year algebra, geometry, trigonometry, and analytic geometry.

Second Section. For Undergraduates and Graduates.

20. Differential and Integral Calculus; Taylor. *Mon., Wed., Fri.,* at 4.50, for six months. Professor Gore.

21. Differential and Integral Calculus; Taylor. *Mon.,* 9.30, *Wed.,* at 9, *Fri.,* at 9.30, for six months. Professor Gore.

22. Differential Equations; Osborne. *Mon., Wed., Fri.,* at 4.50, April and May. Professor Gore.

23. Differential Equations; Osborne. *Mon.,* at 9.30; *Wed.,* at 9; *Fri.,* at 9.30. Professor Gore.

In all of the above courses the text is supplemented by lectures and the principles emphasized by proposing for solution a large number of problems taken from the best European and American authorities.

While the disciplinary value of the study of mathematics is never lost sight of, the importance of its practical application is insisted upon.

Third Section. Primarily for Graduates.

41. Theory of the Complex Variable. Lectures with reference to Durege and Forsyth. Two hours for four months. Professor Gore. (Not given in 1906-07.)

43. Functions. Lectures with reference to Harkness and Morley, Briot, and Legendre. Two hours for four months. Professor Gore. (Not given in 1906-07.)

45. Elliptic Functions. Lectures with reference to Cayley, Tannery and Molk and Kœnigsberger. Two hours.

MECHANICAL ENGINEERING.

FRANK VAN VLECK, M.E., Ph.D. . . . . *Professor*
EDWARD ADAMS MUIR, B.S. . . . . *Assistant Professor of Graphics*
PHILANDER BETTS, E.E. . . . *Assistant Professor of Electrical Engineering*
S. M. WOODWARD, M.S. . . . . *Acting Assistant Professor*
ISAAC ALLISON, B.S., E.E. . . . . *Instructor*

First Section. Primarily for Undergraduates.

1. Machine Design. The designing of machine elements, such as permanent and temporary fastenings, cranks, shafts, belt and toothed gear wheels, connecting, rotating and sliding pieces, by means of empirical and theoretical formulæ developed from applied mathematics and corrected to agree with experience and the best practice. Four hours in the drawing room. *Wed., Fri.*, 4.50 to 6.30.

2. Mechanism. The kinematics of machinery, in which mechanical movements are reduced to scientific analysis; carefully developed problems and diagrams of changes of position and speed in mechanisms. Considerations of motion independent of force; the slider crank train, the Peucellier cell and other special methods of treating kinematic problems; elements of kinematic nomenclature, as the methods of Willis, Reauleaux and others; computations for mechanism or gearing trains. *Tu., Th.*, at 9.30.

3. Mechanical Engineering of Power Plants. A descriptive study of the details comprised in power plants, including steam and gas engines and water turbines; boilers, including study of types, their relative advantages and disadvantages, and management; pumps, injectors and other machinery; selection and location and arrangement of apparatus. Second term, *Mon.*, at 10.30, *Wed.*, at 10, *Fri.*, at 10.30.

4. Mechanical Engineering of Power Plants. Completion of Course 3. First term, *Tu., Th.*, at 9.30.

5. Steam Engineering. Examination into the history of the growth of the steam engine, tracing of the logical development of the idea of the use of steam through successive mechanical and thermal improvements up to the modern steam motor; the rudimentary engine, the single acting and others devoid of mechanism; oscillating and trunk engines; use of the compound and multiple expansion principle; detail study of the modern high pressure, triple expanding and condensing steam engine; laws of thermodynamics in their application to engine design; thermal utilizations, losses and wastes incident to the use of fuel as a motive power;

the indicator diagram and the theta phi diagram; Zeuner diagram; types of valves and reversing gears; the effects of the reciprocating parts and inertia. *Tu., Th.*, at 4.50.

6. Engineering Drawing. Exercise in drawing and design in connection with Courses 3 and 5. The work is under two heads; power plant design and engine design. The first part comprises the complete design with plans and specifications for power plants of various types. Study is made of the plants in this vicinity as well as of the plans of important plants in other cities. The second part embraces the design of high speed and other engines, the valve motion and weight of moving parts being designed to give results which will conform to the requirements of an assumed indicator card. Six hours in the drawing room.

7. Mechanical Laboratory. Practical work in indicating steam engines; determining the evaporative efficiency of boilers; strength of materials; measurement of flow of water; gas engine brake tests; fuel value determinations. The primary object of this course is to afford to students the opportunity of testing machinery for efficiency. Students will be encouraged to adjust their machines for as wide a range of results as possible in order to fully expand the knowledge as to how these results will be thereby changed. Six hours a week, Junior year.

8. Wood-Work. Includes (1) exercises in planing, sawing, mortising, joining, framing, and other work involving the common carpenter's tools; (2) exercises involving the use of power machinery, circular saws, planer, scroll saw, lathe, etc.; (3) exercises in pattern making, including patterns and core boxes for various machine parts; (4) study of molding, casting, and foundry operation. Six hours a week. *Tu., Th.*, 1.30 to 4.30.

9. Metal Work. (1) Exercises in forging, heating, bending, welding, annealing, hardening, tempering, etc., including tool making. (2) Vise-work, including chipping, filing, scraping, polishing, etc. (3) Machine work in metals, including turning, planing, boring, grinding, etc. Six hours a week for Mechanical Engineering students; three hours a week for Electrical Engineering students.

10. Shop Practice and Testing. Consists largely of inspection and study of various mechanical plants; tests of machines, including study of power required for doing work. Three hours a week.

In addition to work in the shops, for each six hours of shop work, one hour is set apart for lectures and recitation, on the uses and handling of tools, operation of machinery, and on shop processes.

Second Section. For Undergraduates and Graduates.

20. Steam Engineering. Completion of Course 5. *Tu., Th.*, at 5.40.

21. Gas Engines. Gas and other internal combustion engines. The theory, design and practice concerning gas, gasoline and other engines. Lecture, laboratory and drawing room work. The starting point will be the study of the chemical conditions involved in gaseous explosion in confined spaces, with the analysis of the resultant thermal changes and final work; comparison of the available energy from illuminating and producer gas, vapors from gasoline, alcohol, etc. The gas engine cycle will be developed, as the two stage, four stage, as well as the possibility of expansion by multiple cylinders; then will follow practical development of the machine as based on its theoretical and chemical needs, with a full description of existing types. Before completion of this course there will be required from each student a complete and finished project or drawing, indicating a completely worked out gasoline engine to fulfil certain required conditions, and to be accompanied by the computations needed to attain the results. The laboratory work will consist of a series of tests for dynamometric power, conducted on the large Westinghouse gas engine at the University building, and other tests on gas mixtures and of power will be made on the small gas engine at the Engineering college. *Mon.*, 4.50 to 6.30.

23. Hydraulic Machinery. Hydraulic prime movers and pumping machinery. A course in theory and design, considering, turbines and laying down of turbine blades to fulfil a specified function; turbines for low and high heads; turbine governors; impulse wheels; water motors of the piston type; machinery for the utilization of hydraulic pressure; hydraulic pressure pumps and hydraulic presses; hydraulic tools; pumps and pumpage by steam, electricity or power; high-duty pumps; water meters. Two hours one term.

24. Machinery of Transmission. A continuation of Course 2. Transmission of power by wire ropes, belts, rods, bands and chains; action of screws and other solid connectors; the principles of gearing, with the limiting types of spur, bevel, helical and skew gears; higher gear trains; intermittent, stop and escapement trains; spur, bevel and rack, cam trains; eccentrics, cranks and other allied direct transmitters; clutches, brakes and other resisters; governors, controllers and regulators; linkages and parallel motions; development of the theory of kinematic nomenclature. *Wed., Fri.*, 5.40.

25. Mechanical Laboratory. A continuation of Course 7. Six hours a week, Senior year.

Third Section. Primarily for Graduates.

40. Advanced Steam-engine Design. Study of proportions of multi-expansion engines, with analysis of valves and link movements by Zeuner and other diagrams. Compilation of dimensions and attained results by reference to examples of best and recent practice.

41. Thermodynamics. See Physics.

42. Hydraulic Machinery. Pumps and pumping engines and the "duty" of pumping machinery and plants. Hydraulic-power applications and hydraulic-power transmission.

43. High Potential Engineering. Use of water under high heads or in large quantities. Study of modern turbines and high-speed wheels. With a library course, examining into the technical features of large hydraulic-power plants in this country or abroad, for this purpose using the files of the Congressional Library. The course is distributed in the three departments of Engineering, as follows:

I. Civil Engineering Problems for plants with large hydraulic heads by the Professor of Civil Engineering.

II. Hydraulic Prime Movers for water under high heads, by the Professor of Mechanical Engineering.

III. High Potential Electric Transmission, by the Professor of Electrical Engineering.

44. Compressed-air Machinery. Design of, with consideration of the mechanical and pneumatic principles. Transmission of air, with application in the arts.

45. Marine Machinery. Screw propulsion, design and proportioning of screws for assumed conditions of speed, displacement and horse-power, with examination into the requirements of engine design for merchant and naval vessels. Special needs of machinery and boilers on board ship, as the use of condensers, evaporators, distillers, etc., with study of the reasons for the design of the various types. Professor Van Vleck.

46. Ordnance Engineering. 1. Exterior ballistics. 2. Interior ballistics, chemistry, and physics of explosives. 3. Metallurgy of gun steels and practice of heavy forgings. 4. Built-up guns, shrinkage, wire-winding, etc. 5. Gun design, mounts, turrets, rapid-fire and automatic guns. 6. Armor and projectiles. 7. Torpedoes and torpedo tubes.

47. Mechanical Refrigeration. Thermic principles involved in production of cold by expansion. Advantages possessed by use of ammonia, air, and other gases or fluids. Types of machines for these purposes in use.

48. Explosion Motors. The chemical and physical theory of, with examination into the essentials of the mechanical design, to be followed with a developed series of tests on the large Westinghouse gas-engine, with which the mechanical-electrical laboratory of the University is provided. Professor VAN VLECK.

49. A thesis on a subject to be selected by the student and which must involve original work, indicating that the writer has some power for original design or investigation. The approval of the subject must be given by the Professor of Mechanical Engineering.

METEOROLOGY.

CLEVELAND ABBE, A.M., LL.D. .... *Professor*

Third Section. Primarily for Graduates.

40. Experimental and Laboratory Work in Meteorology. The lectures treat of the theories of instruments and the laws of atmospheric phenomena, so far as they are susceptible of elucidation by laboratory experiment.

41. Practical Meteorology. The lectures treat of cartography; daily weather charts; methods of predicting the weather for a few days; long-range predictions for seasons; methods of verification; the climates of past geological ages; the methods of reduction and publication.

42. Physical and Theoretical Meteorology. The lectures sketch the present state of our knowledge of atmospheric phenomena as problems in thermodynamics and hydrodynamics, culminating in Bjerknes' treatment of the atmosphere as a field of force. An extensive course of reading and private study is marked out for the pupil, and his thesis for the degree of Ph.D. must be in the field of physical meteorology.

Courses 40, 41, and 42 embrace two lectures weekly and laboratory work.

PHILOSOPHY.

JAMES MACBRIDE STERRETT, A.M., D.D. .... *Professor*
WILLISTON S. HOUGH, Ph.M. .... *Professor*
GEORGE LANSING RAYMOND, L.H.D. .... *Professor of Æsthetics*
WILLIAM T. HARRIS, LL. D. .... *Lecturer*

First Section. Primarily for Undergraduates.

1a. Introductory Course, comprising (1) Formal Logic: Abstract Principles of Deductive and Inductive Inference. Jevons' "Lessons in

Logic." *Mon.*, at 9.30; *Wed.*, at 9. (2) Introduction to Philosophy: Perry's "Approach to Philosophy," with lectures. *Fri.*, at 9.30. First half-year. Professor HOUGH.

1*b*. Introductory Course continued. (1) Elementary Psychology. James's "Psychology: Briefer Course." *Mon.*, at 9.30; *Wed.*, at 9. (2) Introduction to Philosophy. Perry's "Approach to Philosophy," with lectures. *Fri.*, at 9.30. Second half-year. Professor HOUGH.

This introductory course, or an equivalent, is required for admission to all other courses in Philosophy.

2. Psychology. General Course. Stout's "Manual of Psychology," with reference work and theses. *Mon.*, at 10.30; *Wed.*, at 10. Professor HOUGH.

3. Logic. Advanced Course. The Principles of Logic. Hibben's Logic, with reference work in Sigwart's Logic, Bradley's Principles of Logic, Bosanquet's Logic, etc. Theses. Not given in 1906-07; given in 1907-08. Professor HOUGH.

(Courses 2 and 3 are given in alternate years.)

Second Section. For Undergraduates and Graduates.

20. Greek and Christian Ethics. Critical reading of selected Dialogues of Plato and parts of Aristotle's Ethics, with introductory lectures and a sketch of Christian Ethics. First half-year. *Tu.*, *Th.*, at 10.30. Professor HOUGH.

21. Theory of Ethics. With special reference to modern theories. Mackenzie's "Manual of Ethics," supplemented by collateral reading and discussions. Second half-year. *Tu.*, *Th.*, at 10.30. Professor HOUGH.

(Should be preceded by Course 20.)

22. History of Philosophy. From the early Greek cosmologists to the Renaissance. Parts I and II of Rogers' "Student's History of Philosophy," with lectures, reports upon assigned reading, and discussions. First half-year. *Tu.*, *Th.*, at 11.30. Professor HOUGH.

23. History of Philosophy. From the Renaissance to the present time. Part III of Rogers' "Student's History of Philosophy," with lectures, collateral reading, and discussions. Second half-year. *Tu.*, *Th.*, at 11.30. Professor HOUGH.

(Must be preceded by Course 22.)

24. Epistemology. Lectures on the theory of knowledge of the Greek philosophers and first-hand study of the theories of Descartes, Locke, Berkeley, and Hume. First half-year. Two hours. Given in 1905-06; not given in 1906-07. Professor STERRETT.

25. The History and Psychology of Religion. Lecture course with prescribed readings and a thesis. *Wed.*, at 10, and *Fri.*, at 9.30. Professor STERRETT.

26. Æsthetics. Lectures on the philosophical principles of Art: their practical application shown to be similar in all its different departments. First half-year. *Wed.*, at 4.50. Professor RAYMOND.

27. Plato. Special study of The Republic. Knowledge of Greek desirable. Lectures and exposition, with a thesis. One hour a week. Professor STERRETT.

Third Section. Primarily for Graduates.

40. The Philosophy of Nature. A critical study of the fundamental concepts of modern physical science. Prescribed readings, reports, and theses. Second half-year. Two hours. Professor STERRETT.

41. The Critical Philosophy of Kant. Kant's Critique of the Pure Reason and the Prolegomena. Knowledge of German necessary. First half-year. Two hours. Professor STERRETT.

42. The Philosophy of Hegel. Hegel's *Logik* and *Philosophie des Geistes*. Knowledge of German necessary. *Mon.*, 10.30 to 12.30. Professor STERRETT.

43. Metaphysics. The fundamental problems of Philosophy—Materialism, Idealism, Pantheism, Theism. Second half-year. Two hours. Professor STERRETT.

44. The Philosophy of Religion. A lecture course pre-supposing Courses 22, 23 and 25. *Mon.*, at 9.30. Professor STERRETT.

45. The Philosophy of History. A course for graduate work. Conferences, prescribed readings and thesis. Dr. HARRIS.

46. Ten Lectures on the Philosophy of History, supplemented by a syllabus of prescribed readings, with theses and examination. Open to students who have taken at least Courses 22 and 23 in Philosophy and prescribed courses in History. Second term. Dr. HARRIS.

47. Æsthetics. Seminary Course. Æsthetics, considered philosophically, historically, and practically. Conferences, prescribed readings, and thesis. Professor RAYMOND.

48. The Theory of the State. Seminary for topical study and discussion. Willoughby's "The Nature of the State," supplemented by

collateral reading and lectures. Conferences, *Mon.*, 4.45 to 6.15. First half-year. Professor HOUGH.

(Should be preceded by courses in Psychology, Ethics, and the History of Philosophy.)

49. Political Ethics. (In sequence to Course 48.) Green's "Principles of Political Obligation," supplemented by lectures, reports upon collateral reading, and discussions. Conferences, *Mon.*, 4.45 to 6.15. Second half-year. Professor HOUGH.

50. The History of Political Theories. One hour. Professor HOUGH.

PHYSICS.

HOWARD L. HODGKINS, Ph.D. .... *Professor*
EDWARD B. ROSA, Ph.D. .... *Professor*
EDGAR BUCKINGHAM, Ph.D. .... *Lecturer*
OSCAR QUICK, A.M. .... *Instructor*

First Section. Primarily for Undergraduates.

1. General Physics. A recitation and lecture course, embracing the fundamental principles of mechanics, sound, heat, light, and electricity. The lectures are illustrated by experiments. Plane trigonometry is used in the course, and only students who have completed or are studying a college course in trigonometry are admitted. *Mon.*, *Wed.*, *Fri.*, at 4.50. Professor HODGKINS.

2. Laboratory Physics. A selected series of experiments, mainly quantitative. This course is designed to familiarize the student with the ordinary methods of exact experimentation, and to extend the knowledge of the principles of physics as gained in Course 1. Two two-hour periods. *Tu.*, *Th.*, at 10.30. Professor HODGKINS and Mr. QUICK.

Second Section. For Undergraduates and Graduates.

20. Sound. A lecture and laboratory course. Three periods. *Mon.*, at 10.30; *Wed.*, at 10; *Fri.*, at 10.30. Professor HODGKINS.

21. Heat. A lecture and laboratory course, based on Preston's Theory of Heat and Maxwell's Theory of Heat. Three periods. *Mon.*, *Wed.*, *Fri.*, at 5.40. Professor HODGKINS.

22. Light. A lecture and laboratory course, based on Preston's Theory of Light and Schuster's Theory of Optics. Three periods. *Mon.*, at 11.30; *Wed.*, at 11; *Fri.*, at 11.30. Professor HODGKINS.

Third Section. Primarily for Graduates.

40. Light. Advanced study, experimental and mathematical, of some one branch of the subject. Professor HODGKINS.

41. Absolute Electrical Measurements. A course of lectures on the theory and practice of fundamental electrical measurements, including the more important methods for the measurement of resistance in absolute units, the absolute measurement of current and electromotive force, the determination of the ratio of the two systems of electrical units, the theory of various forms of condensers, the calculation of inductances from their dimensions, the experimental determination of capacities and inductances, and other important problems in electrical measurements. A brief history of the present electrical units and an account of the classical investigations by which their values have been determined will also be given. Professor ROSA.

42. Advanced Laboratory Work in Electrical Measurements. A course in advanced laboratory work in electrical measurements, for those who are qualified to undertake it. This may include a considerable range of work, or it may be research work on some important single subject. The amount and character of the work and the time and place at which it shall be done will be determined for each case separately. Professor ROSA.

43. Thermodynamics. The first term is devoted to the development of the theory and usual methods of thermodynamics for systems devoid of passive resistances. The second term is occupied with applications to problems in Physics and Physical Chemistry. Among the subjects discussed the following may be mentioned: Thermal properties of fluids, specific and latent heats, the plug experiment; change of state, heterogeneous dissociation, the phase rule; reactions in gas mixtures, homogeneous dissociation, theory of gas and other explosive engines; electromotive forces; thermodynamic properties of bodies in the electric or magnetic field; laws of radiation. Two hours. Dr. BUCKINGHAM.

44. Theory of Electricity and Magnetism. Maxwell's Electricity and Magnetism is used as a text-book. In the later part of the year some use will be made of Heaviside's Electromagnetic Theory. Familiarity with the rudiments of vector analysis is desirable, but not essential. Two hours. Dr. BUCKINGHAM.

Students who desire to specialize in physics in their undergraduate course should take Courses 1 and 2 in the first year, and should also study mathematics. In the second year one of the courses, 20, 21,

or 22, may be taken; in the third year the two remaining courses may be taken. In order to do this, calculus should be studied during the second year.

The Physical Laboratory is open from 9.30 a. m. to 10 p. m., giving students opportunity to do extra work.

PHYSIOLOGY.

William P. Carr, M.D. .... *Professor*
Charles S. White, M.D. .... *Assistant Professor*
H. C. Elliott, M.D. .... *Instructor*
T. C. Holloway, M.D. .... *Assistant Instructor*

Second Section. For Undergraduates and Graduates.

20. This course consists of lectures, recitations, conferences, and laboratory exercises. The lectures are illustrated by diagrams, models, and prepared specimens. Recitations are held daily on assigned lessons from a standard text-book. Conferences are held weekly. The practical work is conducted in a well-equipped laboratory provided with modern apparatus. Primarily for students of medicine; open to advanced students in Arts and Sciences. Second half-year; lectures, *Mon., Wed., Sat.*, incl., 8.00 a. m.; Laboratory, *Mon., Wed., Fri.*, 2 to 4.

POLITICAL SCIENCE.

*———— .... *Professor of Political Science*
John W. Foster, LL.D. .... *Professor of American Diplomacy*
Charles C. Swisher, Ph.D., LL.D. ... *Professor of History and Politics*
Williston S. Hough, Ph.M. .... *Professor of Political Theory*
James Brown Scott, A.M., J.U.D. .... *Professor of International Law*
Hermann Schoenfeld, Ph.D., LL.D. ...... *Lecturer on European Politics*
Mitchell Carroll, Ph.D. ...... *Lecturer on Roman Political Institutions*

The following courses, given primarily in the Department of Politics and Diplomacy, are open to advanced students in Arts and Sciences. For a complete statement of courses in Political Science, see the announcement of the Department of Politics and Diplomacy, pp. 208-210.

*To be appointed.

Second Section. For Undergraduates and Graduates.

21. Comparative Politics. Two hours. Professor ———.

22. Political History of the United States. Second half-year, two hours. Professor SWISHER.

23. The History of Political Theories. One hour. Professor HOUGH.

24. European Diplomacy. One hour. Professor J. B. SCOTT.

25. History of American Diplomacy and Treaties. First half-year, one hour. Professor FOSTER.

26. British Imperialism. Two hours. Professor SWISHER.

27. Bismarck as a Statesman. First half-year, one hour. (In alternate years; not given in 1906-07.) Professor SCHOENFELD.

28. Disraeli as a Statesman. First half-year, one hour. (In alternate years; given in 1906-07.) Professor SWISHER.

29. Colonial Politics. First half-year, one hour. Professor SWISHER.

30. Problems of Eastern Europe. Second half-year, one hour. (In alternate years; given in 1906-07.) Professor SCHOENFELD.

31. The Oriental Problem. Second half-year, one hour. (In alternate years; not given in 1906-07.) Professor SWISHER.

32. Public Life of the Romans. Second half-year, two hours. Professor CARROLL.

Third Section. Primarily for Graduates.

41. Seminary in Political Science. Professor ———.

42. The Theory of the State. Seminary for topical study and discussion. Willoughby's "The Nature of the State," supplemented by lectures and reports upon collateral reading. Conferences, first half-year. *Mon.*, 4.45 to 6.15. Professor HOUGH.

43. Political Ethics. Green's "Principles of Political Obligation," with lectures, reports, and discussions. Conferences, second half-year. *Mon.*, 4.45 to 6.15. Professor HOUGH.

PREVENTIVE MEDICINE.

GEORGE N. STERNBERG, M.D., LL.D. .... *Professor*

Third Section. Primarily for Graduates.

40. Food preservatives in relation to the Public Health.

41. The hygienic results of milk sterilization.

42. The hygienic results of filtration of municipal water supplies.

43. The use of chemical agents for the sterilization of water supplies, municipal or domestic.

44. The results of legislative and philanthropic efforts to arrest the progress of tuberculosis in the United States, and especially in the principal cities.

PUBLIC LAW.

Charles Willis Needham, LL.D.	*Professor*
John M. Harlan, LL.D.	*Professor*
David J. Brewer, LL.D.	*Professor*
Hannis Taylor, LL.D.	*Professor*
Ernest G. Lorenzen, Ph.D., LL.B., J.U.D.	*Professor*
George Winfield Scott, LL.B., Ph.D.	*Professor*
James Brown Scott, M.A., J.U.D.	*Professor*
Alfred Nerincx, LL.D.	*Professor*
Carl Hau, M.A., LL.B.	*Assistant Professor*

The following courses, given primarily in the Department of Law and Jurisprudence and of Politics and Diplomacy, are open to advanced students in Arts and Sciences. For a complete statement of courses in Public Law, see the announcements of these Departments, pp. 189-194 and 208-210.

Second Section. For Undergraduates and Graduates.

20. Constitutional Law. One hour. Professor Harlan.

21. Origin and Growth of the Constitutional and Common Law of England. Two hours. Professor Taylor.

22. International Law. One hour. Professor Brewer.

23. Public Corporations. One half-year, two hours. Professor Lorenzen.

24. Railroad Law (including Interstate Commerce). Two hours. Professor Needham.

25. Roman Law. Two hours. Assistant Professor Hau.

Third Section. Primarily for Graduates.

41. Roman Law: (1) History and sources of Roman Law before the time of Justinian; (2) the Institutes of Gaius and the Corpus Juris of Justinian; (3) history of the Law during the Middle Ages; (4) Canon Law; (5) seminary in Roman Law. Assistant Professor Hau.

42. Seminary in the Common Law of England. Professor TAYLOR.

43. International Law: (1) International Law; (2) seminary in International Law; (3) International Law of Claims. Professors J. B. SCOTT and G. W. SCOTT.

44. Comparative Constitutional Law. Professor NERINCX.

45. Administrative Law: (1) Administrative Law; (2) Comparative Administrative Law. Professor G. W. SCOTT.

46. Comparative Private Law: (1) Comparative Commercial Law (not given in 1906-07); (2) Spanish-American Law.* Professor LORENZEN.

ROMANCE LANGUAGES AND LITERATURES.

GEORGE N. HENNING, A.M. . . . . *Professor*
OSCAR L. KEITH, A.M. . . . . *Instructor*

FRENCH.

First Section. Primarily for Undergraduates.

1. Grammar, composition, drill in pronunciation. Fraser and Squair's French Grammar. Translation and reading of nineteenth century fiction and history. (400-500 pages.) For beginners. *Tu., Th., Sat.*, at 9.30. Mr. KEITH.

2. Parallel with Course 1. *Tu., Th., Sat.*, at 5.40. Mr. KEITH.

3. Grammar, composition, conversation. Fraser and Squair's French Grammar. Translation and reading. Sandeau, *Mlle. de la Seiglière;* Halévy, *Un mariage d'amour;* Daudet, *Trois Contes;* Mérimée, *Colomba;* A. France, *Sylvestre Bonnard;* Sarcey, *le Siège de Paris;* Coppée, *le Pater;* Molière, *l'Avare.* For outside reading, Zeller, *Richelieu,* or *Henri IV.* (About 1,000 pages.) Open to students who have passed in Course 1 or 2, or have fulfilled the admission requirements in Elementary French. *Mon., Wed., Fri.*, at 3.30. Professor HENNING.

4. Parallel with Course 3. *Tu., Th., Sat.*, at 4.50. Mr. KEITH.

6. General survey of French literature, seventeenth to nineteenth centuries; Warren's French Prose of the Seventeenth Century, Canfield's French Lyrics, Lacombe's *Petite Histoire du peuple français,* Crane's *la Société française au XVII^e siècle,* Corneille, Molière, La Fontaine, Racine, St. Simon, Montesquieu, Marivaux, Voltaire, Buffon, Rousseau, Beaumarchais, Hugo, Musset, Michelet, Balzac, Augier, Maupassant, Pailleron. (About 1,600 pages.) Translation, analyses of works read,

*A reading knowledge of Spanish is required.

collateral reading and reports thereon, lectures on literature, philology and history. Composition. Open to students who have passed in Course 3 or 4, or have fulfilled the admission requirements in Advanced French. *Mon., Wed., Fri.*, at 2.30. Professor HENNING.

Second Section. For Undergraduates and Graduates.

Courses in this group are open to students who have passed in Course 6, or who otherwise satisfy the instructor of their fitness to take them.

21. Seventeenth century literature; history, philosophy, criticism, memoirs, letters, eloquence, drama, fiction, poetry. Balzac, Descartes, Pascal, La Rochefoucauld, La Bruyère, Boileau, St. Simon, Mme. de Sévigné, Bossuet, Corneille, Racine, Molière, Fénelon, Malherbe, La Fontaine, etc. Translation, collateral reading and reports thereon, lectures on literature and history. Thesis. Given in 1906-07. Not given in 1907-08. *Tu., Th.*, at 11.30. Professor HENNING.

23. Eighteenth century literature; history, philosophy, criticism, letters, drama, fiction, poetry. Montesquieu, Diderot, Rousseau, Voltaire, Marivaux, Destouches, Sedaine, Beaumarchais, Bernardin de St. Pierre, André Chénier, etc. Translation, collateral reading and reports thereon, lectures on literature and history. Thesis. Not given in 1906-07.

25. Nineteenth century literature; history, philosophy, criticism, memoirs, travels, fiction, drama, lyric poetry. Thierry, Michelet, Mignet, Thiers, Taine, Sainte-Beuve, Brunetière, France, Lemaitre, Renan, Gautier, Mme. de Staël, Chateaubriand, Dumas père, Hugo, George Sand, Mérimée, Balzac, Flaubert, Daudet, Maupassant, Loti, de Musset, Dumas fils, Augier, Maeterlinck, Rostand, Lamartine, de Vigny, the Romantic poets, the Parnassians, the Symbolists, etc. Translation, collateral reading and reports thereon, lectures on literature and history. Thesis. *Mon.*, at 11..30; *Wed.*, at 11; *Fri.*, at 11.30. Professor HENNING.

Third Section. Primarily for Graduates.

43. Old French and philology. Darmesteter's Historical French Grammar. La Chanson de Roland, etc. Professor HENNING.

47. The comedies of Molière. Professor HENNING.

Other courses may be arranged for competent graduates

SPANISH.

First Section. Primarily for Undergraduates.

1. Grammar, composition. Hills and Ford's Spanish Grammar. Translation and reading of nineteenth century fiction and drama.

(About 700 pages.) Open to first-year students only by permission of the instructor. Open only to students who have had at least one year of French or Latin. Students may not elect Spanish and Italian in the same year. *Mon., Wed., Fri.*, at 4.50. Mr. KEITH.

Second Section. For Undergraduates and Graduates.

20. Translation and reading of nineteenth and seventeenth century works; history, fiction, drama, lyric poetry. (About 1,000 pages.) Lectures on literature and history. Open to students who have passed in Course 1 with at least the grade of C, or who otherwise satisfy the instructor of their fitness to take the course. Not given in 1906-07; given in 1907-08.

ITALIAN.

First Section. Primarily for Undergraduates.

1. Grammar, composition. Grandgent's Italian Grammar, Bowen's Italian Reader. Translation and reading of nineteenth century fiction and drama. (500-600 pages.) Not open to first-year students. Open only to students who have had at least one year of French or Latin. Students may not elect Italian and Spanish in the same year. *Tu., Th.*, at 10.30. Professor HENNING.

SEMITIC LANGUAGES AND LITERATURES.

FRANK LEIGHTON DAY, Ph.D. . . . . *Professor*

First Section. Primarily for Undergraduates.

1. History of the Hebrews. This course covers the history of Israel from the beginning to the Maccabean Age, in successive steps: (*a*) From the beginning to Solomon. (*b*) From Solomon to Nehemiah. *Tu., Th.*, at 10.30.

2. New Testament Times. Including the political, social, and religious life from B. C. 175 to A. D. 70. *Tu., Th.*, at 11.30.

3. Life and Epistles of St. Paul.

Second Section. For Undergraduates and Graduates.

20. A Course for Beginners in Hebrew. Including the acquisition of the grammatical principles of the language, the vocabulary, and careful reading of Genesis, chapters I-VIII. Harper's Introductory Hebrew Method and Elements of Hebrew are used as text-books. *Tu., Th., Sat.*, at 9.30.

21. Historical Hebrew. The Books of Kings, a critical translation; special attention given to vocabulary and syntax. This course is a continuation of Course 20.

22. Prophecy. Its History and Development. This course includes the special study of some of the prophetic books, with the life and times of the writers. *Mon.*, at 10.30; *Wed.*, at 10.

25. The Apostolic Age. A study of the beginning and development of the Christian Church and its relation to the outside world. *Mon.*, at 9.30; *Wed.*, at 9.

Third Section. Primarily for Graduates.

40. The Minor Prophets. A course for advanced students in Hebrew, including Hebrew lexicography, etymology, and syntax.

41. Religion of the Semites. A general survey of the religions of Egypt, Babylonia, Assyria, and Wstern Asia.

42. The Code of Hammurabi and its Relation to the Decalogue.

44. The Life of Jesus. Based on the Gospels.

Other courses may be arranged for competent graduates.

SOCIOLOGY.

(See statement under Economics and Sociology.)

SPANISH.

(See statement under Romance Languages.)

ZOÖLOGY.

THEODORE NICHOLAS GILL, M.D., Ph.D., LL.D. . . . . *Professor*
PAUL BARTSCH, M.S., Ph.D. . . . . *Professor*

First Section. Primarily for Undergraduates.

1. Systematic Zoölogy. I. Invertebrates. This includes lectures and laboratory work. The lectures in their scope cover all the branches of Invertebrates, and correlated with these lectures is the study and dissection of typical specimens in each group. This course is intended to familiarize the student with biological charac-

ters, classificatory laws, and the general principles of evolution. Lecture, one hour; laboratory, two two-hour periods. *Mon., Wed., Fri.,* at 5.40. Professors BARTSCH.

2. Systematic Zoology. II. Vertebrates. This includes lectures and laboratory work. The lectures will cover the various branches of Vertebrata and correlated with these is the study and dissection of typical specimens of each group. Open only to students having completed Course 1. *Mon., Wed., Fri.,* at 4.50. Professor BARTSCH.

Second Section. For Undergraduates and Graduates.

20. Practical Zoology. A lecture course illustrated with lantern slides and demonstrations. In this course only beneficial and injurious animals of all classes will be considered, especial stress being laid upon the problems of preservation and extermination. The course aims to expound the economic side of zoology. Open to all students. One hour. Professor BARTSCH.

21. A Laboratory Course in Histology. This course is designed to acquaint the students with histological technique as well as the minute structure of the various organs composing the body of animals. Three hours. Professor BARTSCH.

22. A Laboratory Course in Physiology. This includes lectures and laboratory work. It considers the constituents of the body and the chemical changes which take place in the vital processes, as well as the secretions and excretions of the body. Prerequisites Course 20. Time to be announced. Professor BARTSCH.

23. Ornithology. A systematic course embracing lectures and laboratory work. The lectures are illustrated with lantern slides, showing the home life of birds. The laboratory work consists in classifying bird skins, of which the University possesses an excellent series. Special attention is directed to the study of the birds of the District of Columbia, and frequent field excursions are made to familiarize the student with the haunts and habits of these forms. Lecture, one hour; laboratory, one two-hour period. *Tu., Th.,* at 4.50. Professor BARTSCH.

24. Comparative Biology. This course consists of lectures and class-room demonstrations treating of the different functions and phenomena of life as they are exhibited in both animals and plants. The lectures occur once a week, and are given by the Professor of Zoology and the Professor of Botany alternately. They discuss the strictly biological processes in Nature—that is, those classed as vital processes—and show their relations and contrasts as viewed from

the two standpoints indicated. The series is based on the general classifications of the two sciences, beginning with the lowest forms. The alternate lectures are in this way co-ordinated; but aside from this mutual plan of procedure, each lecturer treats the subject independently. Wednesday afternoons, one hour; time to be determined. Professors BARTSCH and MANN.

25. Special courses for teachers in the public schools and others desiring to take up special or advanced lines of work may be arranged upon consultation with the professors.

The collections of the United States National Museum and the Smithsonian Institution are consulted in connection with all these courses.

Third Section. Primarily for Graduates.

40. A general course of lectures on the principles of zoology, including a consideration of the philosophy, the methods of investigation, and the systems of zoology as determined by comparative anatomy. The lectures are supplemented by work in the laboratory, embracing histology, microtomy, and dissection. The student is required to take up some subject or group for original investigation. The facilities and collections of the United States National Museum may be made use of. Professor GILL.

SCHEDULE OF RECITATIONS, 1906–1907.

Hour.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Hour.
9.10.	Chapel	Chapel.	9 Applied Mathematics, 20. History, 29. Mathematics, 3,5,7. Mathematics, 21. Philosophy, 1*a*. Semitic, 25.	Chapel.	Chapel.		9.10.
9.30.	Applied Mathematics, 20. History, 29. Mathematics, 3,5,7. Mathematics, 21. Philosophy, 1*a*. Semitic, 25.	Civil Engineering, 3. French, 1. Greek, 20. Mechanical Engineering, 2. Philosophy, 25. Semitic, 20.		Civil Engineering, 3. French, 1. Greek, 20. Mechanical Engineering, 2. Philosophy, 25. Semitic, 20.	Applied Mathematics, 20. Mathematics, 3,5,7 Mathematics, 21. Philosophy, 1*a*.	French, 1. Semitic, 20.	9.30.
10.30.	Applied Mathematics, 21. Civil Engineering, 5 English 3. German, 21. Graphics, 10. Mechanical Engineering, 3. Philosophy, 2. Physics, 20. Semitic, 22.	Civil Engineering, 3, 5. English, 1. German, 20. Italian, 1. Latin, 20. Philosophy, 20, 21. Physics, 2. Semitic, 1.	10 Applied Mathematics, 21. Civil Engineering, 5. English, 3. German, 21. History, 30. Mechanical Engineering, 3. Philosophy, 2. Physics, 20. Semitic, 22.	Civil Engineering, 6, 21. English, 1. German, 20. Italian, 1. Latin, 20. Philosophy, 20, 21 Physics, 2. Semitic, 1.	Applied Mathematics, 21. Civil Engineering, 5, 20. English, 3. German, 21. Graphics, 8. Mechanical Engineering, 3. Physics, 20.	English, 1.	10.30.

11.30.	French, 25. Graphics, 10. Greek, 2. Mathematics, 9, 11. Physics, 22.	Civil Engineering, 3, 5. Electrical Engineering, 3. French, 21. German, 1. History, 2. Philosophy, 22, 23. Physics, 2. Semitic, 5.	11 { French, 25. Greek, 2. Mathematics, 9. 11. Physics, 22. } 12 m. Assembly.	Civil Engineering, 6, 21. Electrical Engineering, 3. French, 21. German, 1. Greek, 22. History, 2. Philosophy, 22, 23. Physics, 2. Semitic, 5.	Civil Engineering, 20. French, 25. Graphics, 8. Greek, 2. Mathematics, 9, 11. Physics, 22.	German, 1. History, 2.	11.30.
12.30.	Recess.	Recess.	Recess.	Recess.	Recess.		12.20.
1.30.	Electrical Engineering, 23. English, 27. German, 5. Graphics, 1*a*. Latin, 1.	Chemistry, 2, 3. Civil Engineering, 6, 21. Electrical Engineering, 4, 5, 24. English, 20. English, 30. Latin, 22. Mechanical Engineering, 7.	Civil Engineering, 21. Electrical Engineering, 23. English, 27. German, 5. Graphics, 1*a*. History, 28. Latin, 1.	Chemistry, 2, 3. Civil Engineering, 6, 21. Electrical Engineering, 4, 5, 24. English, 30. Latin, 23. Mechanical Engineering, 7.	English, 27. German, 5. Graphics, 20. History, 28. Latin, 1.		1.30.
2.30.	French, 6. Graphics, 1*a*. Greek, 1.	Chemistry, 2, 3. Civil Engineering, 1. Electrical Engineering, 4, 5, 24. English, 21. History, 23. Mechanical Engineering, 7.	French, 6. Graphics, 1*a*. Greek, 1. History, 21.	Chemistry, 2, 3. Civil Engineering, 1. Electrical Engineering, 4, 5, 24. English, 21. History, 23. Mechanical Engineering, 7.	French, 6. Graphics, 20. Greek, 1. History, 21.		2.30.

Hour.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Hour.
3.30.	Economics, 1, 2. French, 3. German, 3. Graphics, 1*a*. Latin, 38.	Chemistry, 2, 3. Electrical Engineering, 4, 5, 24. History, 24. Mechanical Engineering, 7.	Economics, 1, 2. French, 3. German, 3. Graphics, 1*a*. Latin, 3.	Chemistry, 2, 3. Electrical Engineering, 4, 5, 24. History, 24. Latin, 2. Mechanical Engineering, 7.	Economics, 1, 2. French, 3. German, 3. Latin, 3.		3.30.
4.50.	Archæology, 22. Architecture, 2. Architecture, 6. Architecture, 23. Economics, 20. Electrical Engineering, 21. English, 2. Geology, 20. Mathematics, 4. Mathematics 20,22 Mechanical Engineering, 21. Physics, 1. Spanish, 1. Zoölogy, 2.	Architecture, 3. Architecture, 20. Chemistry, 1. Civil Engineering, 2. Electrical Engineering, 1, 2. Electrical Engineering, 21. English, 22. English, 34. French, 4. German, 2. Graphics, 1*b*, 2. Mathematics, 6, 8, 10. Mechanical Engineering, 4. Sociology, 20, 21. Zoölogy, 23.	Applied Mathematics, 22. Architecture, 33. Chemistry, 23. Economics, 20. English, 2. Mathematics, 4. Mathematics, 20, 22. Mechanical Engineering, 1. Philosophy, 26. Physics, 1. Spanish, 1. Zoölogy, 2.	Archæology, 22. Architecture, 3. Chemistry, 1. Civil Engineering, 2. Electrical Engineering, 1, 2. Electrical Engineering, 21, English, 22. English, 34. French, 4. German, 2. Graphics, 1*b*, 2. Mathematics, 6, 8, 10. Mechanical Engineering, 4. Sociology, 20, 21. Zoölogy, 23.	Applied Mathematics, 22. Architecture, 23. Chemistry, 23. Greek, 23. English, 2. Geology, 20. Mathematics, 20, 22. Mechanical Engineering, 1, Physics, 1. Spanish, 1. Zoölogy, 2.	Architecture, 2. Architecture, 6 Chemistry, 1. Electrical Engineering, 1, 2. Electrical Engineering, 21. French, 4. German, 2. Mathematics, 6, 8, 10.	4.50.

5.40.	Architecture, 1. Architecture, 33. Chemistry, 26. Civil Engineering, 20. Economics, 25. Economics, 27. English, 5. Geology, 2. Graphics, 8. Mathematics, 12, 14. Mechanical Engineering. 21. Physics, 21. Zoölogy, 1.	Chemistry, 6. Civil Engineering, 22. Economics, 23. Economics, 26. Electrical Engineering, 22. French, 2. Geology, 1. German, 4. Graphics, 1*b*, 2. Graphics, 20. Mathematics, 2. Mechanical Engineering, 20.	Architecture, 21. Chemistry, 26. Civil Engineering, 4. Economics, 3. Economics, 27. Mathematics, 12, 14 Mechanical Engineering, 1. Mechanical Engineering, 24. Physics, 21. Zoölogy, 1.	Architecture, 20. Chemistry, 24. Civil Engineering, 22. Economics, 25. Economics, 26. Electrical Engineering, 22. French, 2. Geology, 1. German, 4. Graphics, 1*b*, 2. Graphics, 20. Mathematics, 2. Mechanical Engineering. 20.	Architecture, 21. Civil Engineering, 4. Civil Engineering, 2[illegible]. Economics, 23. English, 5. Geology, 2. Graphics, 8. Mathematics, 12, 14. Mechanical Engineering, 1. Mechanical Engineering, 24. Physics, 21. Zoölogy, 1.	Architecture 1 Chemistry 24. Civil Engineering, 22. Economics, 3. French, 2. German, 4.	5.40.

EXAMINATIONS.

Examinations are conducted under the following rules of the Board of Trustees:

Examinations for degrees shall close at least three weeks before the end of the scholastic year, and the names of all candidates for degrees who have passed a successful examination shall be officially reported to the President at least two weeks before the date of the commencement.

No student shall be credited with an examination for promotion from a lower to a higher class or to a final examination who is in arrears for tuition.

LIBRARY FACILITIES.

A well-equipped reference library and reading-room is open to students from 9 a. m. to 7 p. m. It contains encyclopædias, dictionaries, standard works in the various departments of study comprised under University subjects, and the leading literary and scientific magazines and reviews. The Germanic Library of the late Professor Richard Heinzel, of the University of Vienna, recently acquired by the University, contains 7,200 volumes and pamphlets bearing on Germanic philology and literature, and a large number of works and periodicals in the cognate branches, especially Anglo-Saxon, Old English, the Romance languages and Slavic.

The Library of Congress is steadily perfecting its collections of standard works in the various branches of university study, and advanced and graduate students are there given every facility for pursuing their investigations. The Public Library of the District of Columbia is being rapidly equipped with books of especial importance to students, and its facilities are available under the most favorable conditions. Under certain restrictions, the libraries of the governmental departments may also be utilized. All these libraries are within easy reach of the University.

TEACHERS' COURSES.

COMMITTEE IN CHARGE.

CHARLES E. MUNROE, *Chairman.*
WILLIAM A. WILBUR.
MITCHELL CARROLL.

For some years the University has opened certain of its courses which relate to those given in the public schools to teachers in the public schools of Washington, and two years ago a regular system

was inaugurated, to be carried into effect annually, in co-operation with the Superintendent of Schools of the District of Columbia.

For 1905-06 the following courses were offered:

Æsthetics. The essentials of the artistic in music, poetry, painting, sculpture, and architecture. *Fri.*, at 4.50, for first half-year. Professor RAYMOND.

Archæology, Classical. Private and public life of the Greeks and Romans. *Mon.*, *Th.*, at 4.50. Professor CARROLL.

Architecture. A history of renaissance architecture down to modern times. *Mon.*, *Fri.*, at 4.50. Professor ASH.

Diplomacy. History of American Diplomacy and Treaties. *Wed.*, *Fri.*, at 5.40. Professor FOSTER.

Economics. An introductory course dealing with the nature and scope of economic science; the evolution and nature of human wants; the concept of value; the determination of price; the factors and methods of production; the movement of products ,and the principles underlying the present system of wealth distribution. *Mon.*, *Wed.*, *Fri.*, at 3.30. Professor VEDITZ.

English. The development of the English novel, with critical studies of selected works, including some contemporary fiction. *Mon.*, *Fri.*, at 5.40. Professor WILBUR.

History. A critical study of the French Revolution and the later progress toward constitutional government in France and the other Continental States. *Tu.*, *Th.*, at 4.50. Professor SWISHER and Dr. HAMILTON.

Law, Constitutional. A study of the Constitution of the United States and of litigation arising under it. *Wed.*, *Fri.*, at 4.50, for first half-year. Justice HARLAN.

The following Free Courses of instruction are offered to teachers during the academic year beginning September, 1906:

Æsthetics. The philosophical principles of art; and their practical application shown to be similar in all its different departments. *Mon.*, *Wed.*, at 4.50. Professor RAYMOND.

Archæology, Classical. The topography and monuments of Athens and Rome, illustrated by plans, photographs, and lantern slides. *Mon.*, *Th.*, at 4.50. Professor CARROLL.

Architecture A. History of Classical and Early Christian Architecture. *Tu.*, at 4.50; *Th.*, at 5.40. Professor BIBB.

Architecture B. History of Renaissance architecture down to modern times. *Mon., Fri.*, at 4.50. Professor ASH.

Biblical Literature. The social life of the Hebrews. *Sat.*, at 4.50. Professor DAY.

English. Shakespeare. The Comedies. *Tu., Th.*, at 4.50. Professor WILBUR.

History. A critical study of the French Revolution and the later progress toward constitutional government in France and the other Continental States. *Tu., Th.*, at 4.50. Professor SWISHER and Dr. HAMILTON.

Law, Constitutional. A study of the Constitution of the United States and of litigation arising under it. *Wed., Fri.*, at 5.40, for first half-year. Justice HARLAN.

Sociology, Theoretical and Practical. This course is divided into two parts. The first part treats of the scope of sociology; its relation to the several social sciences; the various concepts of society; the factors of social evolution; race, environment and heredity; forms of society; the development of social institutions; social progress. The second part considers the treatment of defectives, dependents and delinquents. The principal problems are immigration, pauperism, unemployment, charity organization and poor relief, slums, intemperance, and criminality. The course is not technical, but intended as a preparation for intelligent citizenship. From time to time specialists in social reform work are invited to lecture to the class. *Tu., Th.*, at 4.50. Professor VEDITZ.

Fifteen teachers will be admitted to each course on registration without fee. Regular attendance is expected. Notes must be taken and essays prepared and submitted when called for. Certificates may be issued on application, but a nominal fee will be charged for such certificates.

Application for registration tickets should be made to Mr. A. T. Stuart, Superintendent of Schools.

FEES.

ARTS AND SCIENCES.

1. Matriculation fee (payable only on first entry into the University)	$5
2. Library fee per annum	2
3. Tuition fee per annum for regular undergraduate courses (12 hours or more per week) or for graduate courses during the years of required work	150

4. Laboratory courses:
   Material fees:
      Chemistry 7, Mineralogy, each 5
      Botany, Chemistry 2 and 3, Electrical Engineering, Physics 2 or 3, Zoölogy 1, 20 and 21, each 10
      Chemistry 4 (Assaying) 20
      Chemistry, except 2, 3, 4 and 7, each 25
   Deposits to cover breakage of apparatus issued, the amounts paid in excess of breakage to be returned:
      Chemistry 7 5
      Chemistry 2 and 3, each 10
      Chemistry, except 2, 3, 4 and 7, each 25
5. Fee for graduation 10
6. Tuition fees per annum, for all departments of the University, for special courses on the basis of hours per week throughout the year.
      One hour 25
      Two hours 45
      Three hours 60
      Four hours 70
      Five hours 80
      Six hours 90
      Seven hours 100
      Eight hours 110
      Nine hours 120
      Ten hours 130
      Eleven hours 140
7. Tuition fee for each of the following special courses, not taken by candidates for a degree 40
      Architecture, Courses 37 and 38.
      Chemistry Course 4 (Assaying).
8. Tuition fee per annum for a regular undergraduate course after four years of attendance at full tuition 75
9. In determining tuition fees, three hours of laboratory work in Chemistry and Architecture and two hours of laboratory work in other subjects count as one hour.
10. Fee for a certificate under the seal of the University 2
11. Auditors are admitted to lecture courses for the regular tuition fees, but are not permitted to take active part in the work of the classes and will not be allowed credit, in a subsequent course of studies leading to a degree, for attendance as Auditors. No matriculation or library fee is charged.

No change will be made in the fees fixed at the time of registration except in the case of a change in or withdrawal from a course of studies, and then only upon notice in due form and from the end of the current quarter session when such change or withdrawal shall be approved. Applications for permission to change a course of studies or for the granting of a withdrawal should be made on the prescribed form to be obtained from the Registrar and will only be received at the end of a quarter session.

PAYMENT OF FEES.

All fees are to be paid to the Assistant Treasurer. Tuition fees are payable quarterly in advance. Matriculation, library and laboratory fees are payable in full in advance.

BOARD AND ROOMS.

The price of table board and rooms varies according to locality. Good accommodations may be secured at some distance from the University building for two hundred dollars for the session of thirty-three weeks. In the neighborhood adjacent to the University, by reason of its nearness to the heart of the best business section of the city, prices range from two hundred and fifty to three hundred and fifty dollars for the session of thirty-three weeks. Students frequently form clubs for the purpose of obtaining a reduction in the cost of living. A register of approved boarding-houses is kept by the Assistant Treasurer, who will gladly furnish information in relation thereto, or in connection with any other matters looking to the comfort of students seeking a residence in the city of Washington.

HONORABLE DISMISSION.

An honorable dismission will always be granted to any student in good standing who may desire to withdraw from the University.

For catalogues, application blanks and further information address

THE REGISTRAR,
The George Washington University,
Washington, D. C.

Department of Medicine.

I. FACULTY OF MEDICINE.

(Arranged, with the exception of the President and the Dean, in the several groups in order of collegiate seniority.)

Charles Willis Needham, LL.D.,. . . . . . . President of the University
William F. R. Phillips, M.D. . . . . Dean, Professor of Hygiene and Assistant Professor of Practical Anatomy
J. Ford Thompson, M.D. . . . . Professor of Surgery
Albert F. A. King, A.M., M.D., LL.D. . . . . . Professor of Obstetrics and Dean Emeritus of the Faculty
George N. Acker, A.M., M.D. . . . . Professor of Pediatrics and of Clinical Medicine
Henry C. Yarrow, M.D. Professor of Dermatology
D. Kerfoot Shute, A.B., M.D. . . . . Professor of Anatomy and of Clinical Ophthalmology
William P. Carr, M.D. . . . . Professor of Physiology and of Clinical Surgery
Sterling Ruffin, M.D. . . . . Professor of Theory and Practice of Medicine and of Clinical Medicine.
William K. Butler, A.M., M.D. . . . . Professor of Ophthalmology
Thomas E. McArdle, A.M., M.D. . . . . Professor of Minor Surgery
John Van Rensselaer, A.B., M.D. . . . . Professor of Clinical Surgery
Charles Edward Munroe, Ph.D. . . . . Professor of Chemistry and Toxicology
Charles W. Richardson, M.D. . Professor of Laryngology and Otology
George Wythe Cook, M.D. . . . . Professor of Clinical Medicine
J. Wesley Bovee, M.D. . . . . Professor of Gynecology
Thomas A. Claytor, M.D. . . . . Professor of Materia Medica and Therapeutics and of Clinical Medicine
A. R. Shands, M.D. . . . . Professor of Orthopedic Surgery
James Carroll, M.D. . . . . Professor of Bacteriology and Pathology
Randolph B. Carmichael, M.D. . . . . Professor of Clinical Dermatology
Francis R. Hagner, M.D. . . . . Clinical Professor of Genito-Urinary Surgery and Venereal Diseases
John B. Nichols, M.D. . . . . Professor of Histology
William C. Woodward, M.D., LL.M. . . . . Professor of Medical Jurisprudence
Albert L. Staveley, M.D. . . . . Clinical Professor of Gynecology

William A. White, M.D................Professor of Mental Diseases
Charles H. Clark, M.D......Clinical Professor of Nervous Diseases
I. W. Blackburn, M.D..................Professor of Morbid Anatomy
Arthur A. Snyder ....Clinical Professor of Surgery
Edward E. Morse, M.D..............Assistant Professor of Obstretics
Edward G. Seibert, M.D.............Assistant Professor of Chemistry
Julian M. Cabell, M.D.............Assistant Professor of Obstetrics
D. Webster Prentiss, M.D..........Assistant Professor of Histology
C. S. White, M.D...................Assistant Professor of Physiology
J. F. Mitchell, M.D.........Assistant Professor of Surgical Pathology
Joseph M. Heller, M.D...........Lecturer on Diseases of the Tropics
John R. Wellington, M.D.....Assistant Professor of Clinical Surgery
John H. Lindsey, M.D.............Assistant Professor of Pathology and Curator of the Pathological Museum
Noble P. Barnes, M.D...................Lecturer on Materia Medica
Samuel H. Greene, Jr., M.D..................Instructor in Anatomy
Homer S. Medford, M.D......................Instructor in Obstretics
L. H. Reichelderfer, M.D....................Instructor in Medicine
Edgar P. Copeland, M.D......................Instructor in Surgery
J. L. Riggles, M.D...........................Instructor in Anatomy
H. C. Macatee, M.D......Instructor in Medicine and Clinical Instructor
G. Brown Miller, M.D.....................Instructor in Gynecology
George M. Ruffin, M.D......................Instructor in Anatomy
Thomas M. Price, Ph.D..................Instructor in Bio-Chemistry
Eugene Le Merle, M.D.......Clinical Instructor in Nervous Diseases and Assistant Instructor in Bacteriology and Pathology
Otis D. Swett, B.S..........................Instructor in Chemistry
T. S. D. Grasty, M.D........Instructor in Bacteriology and Pathology
L. H. Taylor, M.D....................Instructor in Clinical Medicine
Henry R. Elliott, M.D.....................Instructor in Physiology
Walter H. Merrill, M.D..........Instructor in Electro-Therapeutics
H. H. Donnally, M.D........Instructor in Bacteriology and Pathology
B. M. Randolph, M.D....................Instructor in Pharmacology
Huron W. Lawson.......Demonstrator of Bacteriology and Pathology
O. A. M. McKimmie, M.D..........Clinical Instructor in Laryngology and Ophthalmology
H. S. Dye, M.D....................Clinical Instructor in Laryngology and Ophthalmology
C. M. Beall, M.D....................Instructor in Physical Diagnosis
H. C. Coburn, M.D...................Instructor in Physical Diagnosis
Wilbur R. Brandenburg, M.D..........Demonstrator of Bacteriology and Pathology
H. P. Parker, M.D........Demonstrator of Bacteriology and Pathology
George B. Heinecke, M.D.........Assistant Demonstrator of Anatomy

Virgil B. Jackson, M.D..........Assistant Demonstrator of Anatomy
Edward Elliott Richardson, M.D., M.S....................Assistant Demonstrator of Anatomy
W. A. Frankland, M.D....Assistant Demonstrator of Anatomy and Assistant Instructor in Clinical Gynecology
R. M. Little, M.D................Assistant Demonstrator of Anatomy
Joseph D. Rogers, M.D............Assistant Demonstrator of Anatomy
Henry M. Jewett, M.D.............Assistant Instructor in Histology
C. L. Davis, M.D....................Assistant Instructor in Histology
J. Lawn Thompson, M.D.............Assistant Instructor in Surgery
J. A. Holmes, M.D..................Assistant Instructor in Histology
Truman Abbe, M.D................Assistant Instructor in Physiology
Charles W. Hyde, M.D.........................Assistant in Surgery
A. L. Hunt, M.D............................Assistant in Surgery
E. T. M. Franklin, M.D.........................Assistant in Surgery
W. J. French, M.D............................Assistant in Surgery

UNIVERSITY HOSPITAL.

VISITING STAFF.

J. Ford Thompson, M.D............................Visiting Surgeon
W. P. Carr, M.D................................Visiting Surgeon
Sterling Ruffin, M.D............................Visiting Physician
Thomas A. Claytor, M.D.........................Visiting Physician
George N. Acker, M.D...........................Visiting Physician
A. F. A. King, A.M., M.D., LL.D................Visiting Obstetrician
Henry C. Yarrow, M.D......................Visiting Dermatologist
D. Kerfoot Shute, M.D....................Visiting Ophthalmologist
Charles W. Richardson, M.D.................Visiting Laryngologist
J. Wesley Bovee, M.D.........................Visiting Gynecologist
W. K. Butler, M.D...............Associate Visiting Ophthalmologist
Julian M. Cabell, M.D...............Associate Visiting Obstetrician
E. E. Morse, M.D......................Associate Visiting Obstetrician
James Carroll, M.D.................................Pathologist

OUT-PATIENT DEPARTMENT.

SURGICAL DISPENSARY.

A. R. Shands, M.D.....................................In charge
J. L. Riggles, M.D....................................Assistant
R. S. Beale, M.D......................................Assistant
T. S. D. Grasty, M.D..................................Assistant
E. L. Mason, M.D......................................Assistant

MEDICAL DISPENSARY.

John H. Lindsey, M.D....In charge
E. P. Copeland, M.D....Assistant
W. A. Frankland, M.D....Assistant
H. C. Macatee, M.D....Assistant
S. H. Greene, Jr., M.D....Assistant
George M. Ruffin, M.D....Assistant
H. C. Coburn, M. D....Assistant
B. M. Randolph, M.D....Assistant
C. M. Beall, M.D....Assistant
H. H. Donnally, M. D....Assistant
C. N. Howard, M.D....Assistant
T. M. Foley, M.D....Assistant

GYNECOLOGICAL DISPENSARY.

J. Wesley Bovee, M.D....In charge
G. Brown Miller, M.D....Assistant
A. B. Hooe, M.D....Assistant
V. B. Jackson, M.D....Assistant
D. W. Prentiss, M.D....Assistant
Samuel Fry, M.D....Assistant

EAR, THROAT, AND NOSE DISPENSARY.

Charles W. Richardson, M.D....In charge
E. G. Seibert, M.D....Assistant
O. A. M. McKimmie, M.D....Assistant

GENITO-URINARY DISPENSARY.

Francis R. Hagner, M.D....In charge
Henry R. Elliott, M.D....Assistant

EYE DISPENSARY.

D. Kerfoot Shute, M.D....In charge
E. G. Seibert, M.D....Assistant

SKIN DISEASE DISPENSARY.

Henry C. Yarrow, M.D....In charge
Randolph B. Carmichael, M.D....Assistant

GENERAL STATEMENT.

The Department of Medicine of The George Washington University is, in the chronological order of its establishment, the seventeenth Medical School in the United States. The first course of lectures began in March, 1825. For many years the school was known as the National Medical College; subsequently as the Department of Medicine of the Columbian University. By virtue of an Act of Congress, approved January 23, 1904, the Columbian University changed its name to "The George Washington University."

When first established, and for many years subsequent, this school, like most others in this country, gave only a two years' course of five months each. In 1878 the course was lengthened by the establishment of a Spring Session, devoted to lectures in certain special subjects. Again in 1879 the course was lengthened to seven months and attendance upon three annual sessions required; in 1893 attendance upon four regular courses was made obligatory upon all candidates for the degree of Doctor of Medicine. The present course of instruction for the degree of Doctor of Medicine extends through four years of eight months each. In order to increase the facilities for actual bedside teaching, the University Hospital was established in 1898 and made a part of the Department of Medicine. In 1902 the old building, in which the exercises were held since 1867, gave place to the present enlarged and commodious building.

The academic year begins on the last Wednesday in September and ends on the first Wednesday in June. The next session, the eighty-sixth, begins September 26, 1906, and ends June 5, 1907. Students must register their names promptly at the Registrar's office at the beginning of the session, in order that their time of study shall count as a full year. Examinations are held at the conclusion of the instruction in each subject; examinations are written, oral, and practical, so far as the nature of the subjects permit. Degrees are conferred at Commencement, the first Wednesday in June, and at the Winter Convocation, February 22.

For catalogues and other information address either the Registrar of the University or the Dean of the Department of Medicine, The George Washington University, Washington, D. C.

ADMISSION.

Candidates for matriculation must show that they are fitted by previous education to study medicine. For this purpose they must present a satisfactory certificate of their attainments from an approved school or college, or they must pass an examination.

Beginning with the session of 1909-10 no student will be matriculated for the degree of Doctor of Medicine (*a*) who has not completed satisfactorily in an approved college or scientific instituton two years of work of a regular course for a baccalaureate degree or (*b*) who does not possess equivalent educational training and acquirements.

Applicants for matriculation will be required (*a*) to submit certificates, duly authenticated, of the college or scientific institution in which their work was done, setting forth the courses taken and the grades attained or (*b*) to pass satisfactorily examinations equivalent to the final examinations in subjects of the sophomore year of approved colleges or scientific institutions and aggregating fifteen units. In both cases, (*a*) and (*b*), one unit must be in physics and one unit in chemistry.

Admission Without Examination.

Candidates are admitted without examination:

(1) Upon presenting a diploma or certificate of an approved college conferring on them the degree of A.B. or B.S., or an equivalent degree in the arts and sciences.

(2) Upon presenting a diploma or certificate of graduation from a high school, academy, or preparatory school approved by the University as maintaining an adequate standard.

(3) Upon presenting a certificate of admission to the freshman class of an approved college.

(4) Upon presenting a medical student's certificate issued by a State board.

(5) Upon presenting a certificate of admission to another medical school approved by the University as maintaining an adequate standard.

Admission by Examination.

Candidates unable to comply with the foregoing requirements are admitted upon passing an examination based upon the general requirement for admission to the Freshman Class of the Department of Arts and Sciences of the University, which is a four-year high-school course, or its equivalent. This examination comprises subjects selected from the annexed list equal to 15 units. For admission to the Department of Medicine nine (9) of the 15 units are required in the following subjects:

	Units.
English	4
Mathematics	3
Physics	1
Latin	1
Total	9

The other 7 units may be selected from the other subjects. A unit is considered the equivalent of one year's high-school work in a subject.

LIST OF SUBJECTS.

English:	Units.
(*a*) Grammar	1
(*b*) Rhetoric and Composition	1
(*c*) Literature—a knowledge of the form, subject-matter, and literary history of prescribed works is required	2

The following are the works prescribed for 1906-07: Burke's Speech on Conciliation, Macaulay's Essay on Milton, Macaulay's Life of Johnson, Milton's L'Allegro, Il Penseroso, Comus, and Lycidas; Shakespeare's Julius Cæsar. Equivalent readings may be offered.

Latin:	Units.
(*a*) Elementary Grammar	1
(*b*) Cæsar's Commentaries, Books I-IV	1
(*c*) Advanced Latin	2
Greek:	
(*a*) Elementary Grammar	1
(*b*) Xenophon or Homer	1
(*c*) Advanced Greek	1
Modern Languages:	
(*a*) Elementary French Grammar	1
(*b*) French, translation of easy prose	1
(*c*) Elementary German Grammar	1
(*d*) German, translation of easy prose	1
History:	
United States	1
English	1
Greek and Roman	1
General	1
Mathematics:	
(*a*) Algebra through quadratics	1½
(*b*) Plane Geometry	1
(*c*) Plane Trigonometry	½
(*d*) Advanced Mathematics	1
Sciences:	
Physics	1
Chemistry	1
Astronomy	½

	Units.
Biology	1
Geology	½
Botany	1
Physical Geography	½
Physiology	½
Ethics	½
Economics	½

The scope of the different subjects is indicated by standard high-school text-books.

Candidates may offer other subjects than those stated in the foregoing list of subjects, and if they are acceptable examinations will be arranged. A candidate may offer certificates of an approved school for work done in any of the foregoing subjects, and will be credited with the units represented by such work. A candidate failing to pass in two of the subjects of his examination may be admitted to the first year upon the condition that he make up the deficiency before entering the second-year class. The examinations are conducted by examiners appointed by the Superintendent of Schools of the District of Columbia.

As the laws relating to the preliminary educational qualifications required of students of medicine differ in many of the States of the Union, candidates are advised to make themselves familiar with the provisions of the medical statutes of the States in which they contemplate applying for license to practice. Attention to this precaution may save future embarrassment.

Examinations for admission to the first-year Medical class will be held in Hall No. 2 of the Medical Building in accordance with the following schedules:

May 28 and September 17, 10 a. m., English.
May 29 and September 18, 10 a. m., Mathematics.
May 31 and September 19, 10 a. m., Physics.
June 1 and September 20, 10 a. m., Latin.
June 2 and September 21, 10 a. m., Electives.

Admission of Students from Other Schools.

Students of other recognized and approved medical schools may be admitted to this school as follows:

Those qualified to enter the second year of their own school may be admitted to the second-year class of this school; those qualified to enter the third year of their own school to the third year of this school, and those qualified to enter the fourth year of their own school to the fourth year of this school, provided, however, that the subjects pursued by the applicants in their previous year or years

are reasonably equivalent to those required in the same year or years of this school, and that the requirements for advancement from class to class are the equivalent of those in this school. Applicants may be required to submit to examination in all the subjects pursued by the previous class of this school.

ADVANCED STANDING.

No advanced standing can be given for degrees in Dentistry, Veterinary Medicine, or Pharmacy.

Students holding degrees in Arts, Science, or Philosophy, who in the course of study for their degrees have pursued studies in chemistry, physiology, anatomy, histology, bacteriology, or pathology, equivalent to the courses in these subjects in this school, may upon satisfactory evidence of their proficiency be credited with such studies.

SPECIAL STUDENTS.

Students, approved by the Dean, not candidates for the degree of Doctor of Medicine, may be admitted without examination to pursue any course they may elect. Such courses cannot, however, be subsequently considered as time spent in the course for the degree of Doctor of Medicine. Nor can such students enter upon the regular medical course without complying with all the regular requirements for admission.

WITHDRAWALS.

A certificate of work actually done will be given to any student wishing to withdraw or transfer to some other school during the session. Written notice of such withdrawal or transfer must be filed with the Dean at the time of requesting the certificate, and the student must have paid all fees and dues chargeable against him up to the end of the quarter in which he withdraws.

CLASSIFICATION OF STUDENTS.

Students are divided into four classes, according to their proficiency, and the time spent, viz., first year, second year, third year, and fourth year. Students cannot advance to a higher class unless they pass the examinations in the major subjects of the class in which they are registered, and they can be conditioned in not more than two minor subjects. Students failing in a major subject and not more than two minor subjects will be permitted at the next examination period a re-examination in the subjects in which they fail.

The Faculty may dismiss any student from the school, if in its judgment such student be deemed an unsuitable person, intellectually or otherwise, for the profession of medicine.

ORDER OF INSTRUCTION.

A change in the arrangement of the subjects of the curriculum went into effect with the session of 1905-06. This change was made in order to secure a more logical correlation of the subjects, enabling the student to utilize his time to better advantage.

The subjects studied in each year are shown in the following table:

First year.	Second year.	Third year.	Fourth year.
Histology.	Organic and Physiological Chemistry.	Practice.	Clinical Medicine.
Anatomy.	Bacteriology.	Surgery.	Clinical Obstetrics
Physiology.	Pathology.	Obstetrics.	Clinical Surgery.
General Chemistry.	Materia Medica.	Therapeutics.	Laryngology.
	Hygiene.	Gynecology.	Otology.
	Clinical Microscopy.	Clinics.	Ophthalmology.
	Physical Diagnosis.		Dermatology.
			Psychiatry.
			Pediatrics.
			Neurology.

The general order of study is as follows:

First year, first half. Histology, Anatomy, Lectures on General Chemistry.

First year, second half. General Chemistry, Physiology, Anatomical Laboratory.

Second year, first half. Organic and Physiological Chemistry, Bacteriology.

Second year, second half. Pathology, Materia Medica and Pharmacology, Hygiene, Clinical Microscopy, Physical Diagnosis.

During the third year Therapeutics, Surgery, Obstetrics, Practice, and Gynecology are studied.

The greater part of the fourth year is devoted to clinical work in the hospitals. During this year, however, general instruction is also given in Mental Diseases, Neurology, Dermatology, Ophthalmology, Laryngology, and Otology. Not less than 1,000 hours of clinical work is required.

OPTIONAL FIVE-YEAR COURSE.

Beginning with the session of 1905-06 a five-year optional course is offered. In this course the subjects, selected from the regular four-year course, are as follows:

First year.	Second year.	Third year.	Fourth year.	Fifth year.
Anatomy.	Physiological and Organic Chemistry.	Bacteriology	Practice.	Clinical Medicine.
Histology.	Physiology.	Pathology.	Surgery.	Clinical Obstetrics.
General Chemistry.	Materia Medica.	Hygiene.	Obstetrics.	Clinical Surgery.
		Therapeutics.	Gynecology.	Laryngology.
		Clinical Microscopy.		Otology.
				Ophthalmology.
				Dermatology.
				Psychiatry.
				Pediatrics.
				Neurology.

This course requires an average of not less than 800 hours annually.

Examinations are held at the end of each course. Subsequently recitations are had in each subject in order that the knowledge acquired may be kept fresh in mind. A general examination is held at the end of the fourth year, for the optional course at the end of the fifth year.

ANATOMY.

D. Kerfoot Shute, A.B., M.D. .... *Professor of Anatomy*
W. F. R. Phillips, M.D. ..... *Assistant Professor of Practical Anatomy*
Geo. B. Heinecke, M.D. .... *Assistant Demonstrator of Anatomy*
Virgil B. Jackson, M.D. .... *Assistant Demonstrator of Anatomy*
E. E. Richardson, M.D., M.S. ..... *Assistant Demonstrator of Anatomy*
W. A. Frankland, M.D. .... *Assistant Demonstrator of Anatomy*
S. H. Greene, Jr., M.D. .... *Instructor in Anatomy*
J. L. Riggles, M.D. .... *Instructor in Anatomy*
R. M. Little, M.D. .... *Assistant Demonstrator of Anatomy*
Geo. M. Ruffin, M.D. .... *Instructor in Anatomy*
Jos. D. Rodgers, M.D. .... *Assistant Demonstrator of Anatomy*

The course in Anatomy is given in a series of lectures, demonstrations, recitations from text-books, and practical laboratory work. The purpose of the lectures is to prepare the student for his practical work in the laboratory. The lectures are illustrated by lantern slides, models, charts, and diagrams. The class is divided into small sections for the purpose of demonstrating the bones, joints, actual dissections, and frozen sections. The student, having been so prepared, is required to dissect satisfactorily one lateral half of the cadaver. Throughout the course every opportunity is taken to emphasize the application of Anatomy to the practice of medicine in all its departments. The course is practically completed in the first year, but, realizing the fundamental importance of anatomy to medicine, review recitations and demonstrations are provided weekly during the second year.

Text-books: Cunningham's Text-book of Anatomy, Gray's Anatomy, Cunningham's Manual of Practical Anatomy.

Collateral reading: Quain's Anatomy, Spalteholz's Anatomy, Taylor's Applied Anatomy, Wiedersheim's Structure of Man.

Graduate Course in Anatomy of the Nervous System.

This course includes laboratory work, readings, and recitations. The nervous system is investigated in typical animals of the different classes, especially with the view of gaining some insight into the phylogeny of the central nervous system in man. The growth of the brain and its physical characters as related to intelligence are investigated. The histology and embryology of the central nervous system and the sense organs are studied. A history of the guiding conceptions in neurology is to be acquired. The course is designed to inculcate a sound knowledge of the architecture and functions of the nervous system of man for the use of students of anatomy, medicine, and psychology.

HISTOLOGY.

John B. Nichols, M.D. .... *Professor of Histology*
D. Webster Prentiss, M.D. .... *Assistant Professor of Histology*
Henry M. Jewett, M.D. .... *Assistant Instructor in Histology*
C. L. Davis, M.D. .... *Assistant Instructor in Histology*
J. A. Holmes, M.D. .... *Assistant Instructor in Histology*

Instruction in Histology is given in the first half of the first year. The minute structure of the tissues and organs of the body is presented in a systematic course of lectures illustrated by images, and specimens thrown on the screen by means of the projection microscope. The same specimens are also studied under the microscope. Recitations are held upon the subjects shown and studied. Practical instruction is given in microscopical technique, the care and manipulation of the microscope, and the preparation of specimens.

Text-book: Nichols's Histology.

Collateral reading: Böhm and von Davidoff's Histology, Stohr's Histology.

PHYSIOLOGY.

William P. Carr, M.D. .... *Professor of Physiology*
Charles S. White, M.D. .... *Assistant Professor of Physiology*
H. C. Elliott, M.D. .... *Instructor in Physiology*
Truman Abbe, M.D. .... *Assistant Instructor in Physiology*

This course consists of lectures, recitations, conferences, and laboratory exercises. Lectures are given daily during the second half of the first year, and cover all the important facts and theories pertaining to the subject. The lectures are illustrated by diagrams, models, and prepared specimens. Recitations are held daily on assigned lessons from a standard text-book. Conferences are held weekly. The practical work is conducted in a well-equipped laboratory provided with modern apparatus. An abundant supply of material is kept throughout the year. Each student is required to set up apparatus and perform a number of experiments under the direction of an instructor. Demonstrations are given only when the experiment is such that it cannot be carried out by the student. The student is required to keep a record of the exercises performed, and these are regularly criticised by the instructors. The class is divided into small sections, so that each student receives a large amount of personal attention. A series of review recitations is conducted weekly during the second year, special emphasis being laid

upon the relation of normal physiological function to pathological function.

Text-book: Kirke's Physiology.

Collateral reading: Landois' Physiology, American Text-book of Physiology, Raymond's Physiology.

CHEMISTRY.

CHARLES E. MUNROE, Ph.D.....*Professor of Chemistry and Toxicology*
EDWARD G. SEIBERT, M.D..............*Assistant Professor of Chemistry*
THOMAS M. PRICE, Ph.D.................*Instructor in Bio-Chemistry*
OTIS D. SWETT, B.S.........................*Instructor in Chemistry*
ELMER S. NEWTON, M.D.....................*Instructor in Chemistry*
ARTHUR N. TASKER, B.A....................................*Assistant*
ERNEST W. BROWN, Ph.D...................................*Assistant*

General Chemistry. A series of illustrated lectures, accompanied by recitations and exercises, on theoretical, inorganic, organic, and technical chemistry. *Tu., Th., Sat.*, at 4.50 p. m. Professor MUNROE, Mr. SWETT.

Organic Chemistry. A series of lectures and recitations on the acyclic and cyclic hydrocarbons and their derivatives, with special reference to physiology and medicine. *Mon., Th.*, at 5.40 p. m. Professor MUNROE.

Physiological Chemistry. A series of lectures and recitations on the proximate principles of the human body, such as the proteids, carbohydrates, fats, and the relation of the chemical constitutions of these bodies to physiological processes, together with a consideration of the principal secretions and excretions of the human body. Asst. Professor SEIBERT.

Analytical Chemistry. A brief course in qualitative and quantitative analysis, with a view to acquainting the student with those methods which may be applied in medicine and the special tests for the alkaloids. Professor MUNROE, Asst. Professor SEIBERT, Assistants TASKER and BROWN.

Clinical Analysis. A laboratory course covering urinanalysis, examinations of the gastric fluid, analyses of milk and of water, a study of alkaloidal reactions, and a practical examination of the chemical properties of the substances treated of in the course of physiological chemistry. Professor MUNROE, Asst. Professor SEIBERT, Assistants TASKER and BROWN.

Volumetric Analysis. A brief laboratory course, introducing acidimetry and alkalimetry as a basis for quantitative examination of water, urine, and gastric fluids. Professor MUNROE and Dr. NEWTON.

Text-books. Holland's Medical Chemistry and Toxicology, Long's Text-books of Physiological Chemistry, Platt's Manual of Qualitative Analysis and Medical Chemistry.

Collateral reading: Simon's Manual of Chemistry, Hammarsten's Physiological Chemistry, Richter's Organic Chemistry, Barker's Text-book of Elementary Chemistry.

ADVANCED WORK.

Bio-Chemistry. A laboratory course in the chemical examination of some of the chief foodstuffs, the tissues and fluids of the body, and the products of certain organisms; also the isolation of the digestive enzymes and a study of their action *in vitro*. Dr. PRICE.

MATERIA MEDICA AND THERAPEUTICS.

THOMAS A. CLAYTOR, M.D.............. *Professor of Materia Medica and Therapeutics*
NOBLE P. BARNES, M.D.................... *Lecturer on Materia Medica*
WALTER H. MERRILL, M.D.......... *Instructor in Electro-Therapeutics*
B. M. RANDOLPH........................ *Instructor in Pharmacology*

This course is given in the second and third years.

Second year. (1) Lectures upon Materia Medica, including a demonstration of drugs and their preparations. (2) Recitations upon the preparations, their doses, and the various antidotes for poisons. (3) Practical exercises in prescription writing. (4) An optional course in Pharmacy is offered.

Third year. (1) Systematic lectures upon the physiological action of drugs and their effects in health and disease, their therapeutic uses, and their methods of administration. (2) Lectures and section demonstrations in electro-therapeutics. (3) Demonstrations in the laboratory illustrating the physiological action of the more important drugs. (4) Prescription writing, in which the students are given hypothetical cases for which to prescribe. Prescriptions are corrected and returned to the students. Students are also required to write prescriptions upon the black-board before the class, and other members are called upon to criticise, correct mistakes, suggest improvements or objections.

Text-book: Wood's Therapeutics.

Collateral reading: Hare's Practical Therapeutics, Culbreth's Materia Medica and Pharmacy, Cushing's Pharmacology.

BACTERIOLOGY AND PATHOLOGY.

James Carroll, M.D. .... *Professor of Bacteriology and Pathology*
John H. Lindsey, M.D. .... *Assistant Professor of Pathology and Curator of Pathological Museum*
T. S. D. Grasty, M.D. .... *Instructor in Bacteriology and Pathology*
H. H. Donnally, M.D. ...... *Instructor in Bacteriology and Pathology*
Eugene Le Merle, M.D. .. *Demonstrator of Bacteriology and Pathology*
Huron W. Lawson, M.D. .... *Demonstrator of Bacteriology and Pathology*
Wilbur R. Brandenburg, M.D. .... *Demonstrator of Bacteriology and Pathology*
H. C. Coburn, M.D. .... *Demonstrator of Bacteriology and Pathology*
H. P. Parker, M.D. .... *Demonstrator of Bacteriology and Pathology*

The course in Bacteriology and Pathology is given in the second year. In Bacteriology the work includes (1) the preparation of the various culture media, (2) the principles of disinfection and sterilization, and (3) the methods of cultivating, staining, and studying bacteria. Special attention is given to the pyrogenic organisms and the bacilli of diphtheria and tuberculosis.

The latter half of the session is devoted to Pathology, and the student is now prepared to appreciate the association of bacteria with certain definite lesions in the tissues. After the detailed study of inflammation, the diseases of the various organs are taken up in succession. For this purpose sections illustrating the various pathological conditions are carefully selected and given to the student to be stained, mounted, and studied under the immediate supervision of an instructor. These sections thereafter become the property of the student. The course terminates with the microscopical study of the several varieties of tumors.

The course in Clinical Microscopy is given at the conclusion of that in Pathology. It embraces the study of fresh and stained preparations of human blood in normal and pathological conditions; the Widal test for typhoid fever; the developmental stages of the malarial parasites in the blood and in the mosquito; the common forms of intestinal parasites and the microscopical examination of the urine. In the fourth year students are required to spend two weeks in the clinical laboratory of the University or other approved hospitals.

Text-books: Abbott's Principles of Bacteriology, Durch's General Pathology, Ziegler's Pathological Anatomy.

Advanced Work.

Advanced students who desire to continue the work are encouraged to undertake bacteriological and pathological studies of the cases that come to autopsy.

Candidates seeking Master's degrees may undertake special studies and practical research work in Bacteriology, provided they have already taken at least one course of study in this subject, including elementary practical work in the laboratory.

Candidates for the degree of Doctor of Philosophy may elect to take Bacteriology either as a major or a minor topic. In the former case they must submit evidence to show that they have already received at least a single complete course of instruction, including the necessary elementary practical work in this subject.

HYGIENE.

W. F. R. Phillips, M.D. .... *Professor of Hygiene*

The course in Hygiene is devoted to teaching the relations of habits and surroundings to health. Consideration is given to domestic and municipal sanitation and to the principles underlying legislative interference in matters of public health. This course is given principally by recitation from a prescribed text-book. The subject is taught in the second year.

Text-book: Harrington's Hygiene.

Collateral reading: Notter and Firth's Hygiene.

SURGERY.

J. Ford Thompson, M.D. .... *Professor of Surgery*
Thos. E. McArdle, M.D. .... *Professor of Minor Surgery*
A. R. Shands, M.D. .... *Professor of Orthopedic Surgery*
James F. Mitchell, M.D. ..... *Assistant Professor of Surgical Pathology*
E. P. Copeland, M.D. .... *Instructor in Surgery*
J. Lawn Thompson, M.D. .... *Assistant in Surgery*
Charles W. Hyde, M.D. .... *Assistant in Surgery*
A. L. Hunt, M.D. .... *Assistant in Surgery*
W. J. French, M.D. .... *Assistant in Surgery*
E. T. M. Franklin, M.D. .... *Assistant in Surgery*

The instruction given in this course embraces systematic lectures upon the principles and practice of surgery. Recitations are held twice a week, in which the subjects presented by the lecturer are impressed

upon the students. The different surgical operations are illustrated upon the cadaver, and the uses of all the important surgical instruments and appliances are demonstrated in the same manner.

Minor Surgery. Practical instruction is given in the application of splints, bandages, and dressings used in the various surgical diseases and injuries. Lectures and practical instruction are also given in the preparation of materials used in antiseptic and aseptic surgery, the preparation of the patient, sterilization of the instruments, and the methods of administering anesthetics.

Orthopedics. A course of lectures and recitations on the pathology, etiology, course, and termination of chronic joint diseases is given.

Surgical Pathology. A systematic series of demonstrations upon the pathological anatomy of surgical diseases and injuries is given. These demonstrations are supplemented by reference to microscopical specimens, charts, photographs, and diagrams.

Text-books: American Text-book of Surgery, Wharton's Minor Surgery.

Collateral reading: von Bergmann's System of Surgery, Park's Surgery by American Authors.

CLINICAL SURGERY.

J. Ford Thompson, M.D. .... *Professor of Clinical Surgery*
Charles W. Richardson, M.D. ..... *Clinical Professor of Laryngology*
John Van Rensselaer, A.B., M.D. ...... *Clinical Professor of Surgery*
W. K. Butler, M.D. .... *Clinical Professor of Ophthalmology*
D. Kerfoot Shute, A.B., M.D. ... *Clinical Professor of Ophathalmology*
William P. Carr, M.D. .... *Professor of Clinical Surgery*
A. R. Shands, M.D. .... *Clinical Professor of Orthopedic Surgery*
Francis R. Hagner, M.D., *Clinical Professor of Genito-Urinary Surgery*
John R. Wellington, M.D. .... *Assistant Clinical Professor of Surgery*
Arthur A. Snyder, M.D. .... *Clinical Professor of Surgery*

General Surgery. In the third year amphitheater clinics are given, at which the general principles of surgical diagnosis and of operative technique and procedure are emphasized and illustrated.

General and Special Surgery. In the fourth year the class is divided into sections for the study and examination of surgical cases in the hospital wards. The students are also assigned to work as dressers and assistants on the surgical out-patient departments of the different hospitals. Practical work is required of each student in preparation of dressings, sterilization of instruments, and operations on the cadaver. In the latter part of the year each student is given an opportunity to assist at a major operation. The clinical work is supplemented by the study and discussion of case histories.

In ophthalmology, otology, and laryngology the students are required to attend a certain number of clinics, and each student must report upon one assigned case.

In orthopedics they are required to take clinical instruction in the application of special apparatus and of plaster of paris to the correction of deformities.

Instruction in genito-urinary surgery and in cystoscopy is given in clinics and in section work.

OBSTETRICS.

Albert F. A. King, A.M., M.D., LL.D........*Dean Emeritus, Professor of Obstetrics*
Edward E. Morse, M.D..............*Assistant Professor of Obstetrics*
Julian M. Cabell, M.D..............*Assistant Professor of Obstetrics*
H. S. Medford, M.D..........................*Instructor in Obstetrics*

The course in Obstetrics comprises a series of lectures on the science and art of midwifery, and is given in the third year. The chief purpose of the lecturer is to arrange, simplify, and explain the matters studied in the text-books, so as to render them more easily intelligible and to indicate their relative importance. The lectures are illustrated by diagrams, models, manikins, natural preparations, and instruments. The class is divided into sections, and each student performs various obstetrical operations upon the manikin. Recitations from text-books are held throughout the term. In the fourth year clinical instruction in obstetrics is given, the class being divided into small sections and each section being required to attend a stated number of cases.

Text-book: King's Manual of Obstetrics.

Collateral reading: Hirst's Obstetrics, Williams' Obstetrics, Jewett's Practice of Obstetrics.

THEORY AND PRACTICE OF MEDICINE.

Sterling Ruffin, M.D..............*Professor of Theory and Practice*
L. H. Reichelderfer, M.D......................*Instructor in Medicine*
H. C. Macatee, M.D...........................*Instructor in Medicine*
C. M. Beall, M.D....................*Instructor in Physical Diagnosis*
H. C. Coburn, M.D...................*Instructor in Physical Diagnosis*

The method of instruction employed in this subject is as follows: (1) Lectures with weekly recitations. (2) Clinical lectures at the University Hospital, with practical instructions in the art of diagnosis and methods of taking and recording the history of medical cases.

(3) Laboratory instruction in the use of instruments of research for the clinical study of sputum, blood, feces, etc. (4) A course of lectures to the class in physical diagnosis.

Text-books and works of reference: Osler's Practice of Medicine, Tyson's Practice of Medicine, Anders' Practice of Medicine, Sahlinger and Kalteyer's Modern Medicine, Hare's Practical Diagnosis, Musser's Clinical Diagnosis, Simon's Clinical Diagnosis, Klemperer's Clinical Diagnosis, Cabot's Clinical Examnation of the Blood.

CLINICAL MEDICINE.

Geo. N. Acker, A.M., M.D. .... *Professor of Clinical Medicine*
G. Wythe Cook, M.D. .... *Professor of Clinical Medicine*
Thos. A. Claytor, M.D. .... *Professor of Clinical Medicine*
Sterling Ruffin, M.D. .... *Professor of Clinical Medicine*
Eugene Le Merle, M.D. .... *Clinical Instructor in Nervous Diseases*
H. C. Macatee, M.D. .... *Clinical Instructor in Medicine*
L. H. Taylor, M.D. .... *Instructor in Clinical Medicine*

Clinical Medicine is taught during the third and fourth years. Instruction is given by means of clinical lectures, ward classes, actual bedside work by the students, and conferences at which the cases studied are thoroughly discussed.

The work for the third and fourth years is graded and distinct.

Third year: The class is divided into sections, and weekly each section receives instruction in clinical diagnosis. An amphitheater clinic is given weekly, at which methods of diagnosis and treatment are presented and the use of instruments of precision illustrated and explained.

Fourth year: The class is divided into sections of two students each. These sections, under the direction of instructors, are held responsible for the conduct of the cases assigned them. They are required to obtain the histories, make the physical examination, determine the diagnosis, and institute the treatment; they also make the necessary clinical laboratory examinations.

Weekly conferences are held, at which the cases studied by the sections are presented and discussed under the supervision of the clinical teachers.

Amphitheater clinics are given, at which interesting or unusual cases are presented and explained by the clinical professors.

The clinical instruction is also supplemented by the study and discussion of case histories.

GYNECOLOGY.

J. Wesley Bovée, M.D. . . . . *Professor of Gynecology*
G. Brown Miller, M.D. . . . . *Instructor in Gynecology*
A. L. Staveley, M.D. . . . . *Professor of Clinical Gynecology*
W. A. Frankland, M.D. . . . . *Assistant Instructor in Clinical Gynecology*

The subject of Gynecology is taught in the third year in a course of lectures and text-book recitations. In the fourth year the class is taken in sections of one to two students each into the Gynecological Dispensaries for clinical instruction in examinations, diagnosis, and treatment. In larger sections the class attends amphitheater clinics given by the Professors of Gynecology and Clinical Gynecology.

Text-books: Bovée's Practice of Gynecology, Hirst's Diseases of Women.

Collateral reading: Dudley's Gynecology, Penrose's Diseases of Women, Montgomery's Text-book of Gynecology.

NERVOUS DISEASES.

Charles H. Clarke, M.D. . . . . . *Clinical Professor of Nervous Diseases*

Lectures and clinics are given upon the more common and important nervous affections. This course is given in the fourth year.

Text-book: Oppenheimer's Nervous Diseases.

LARYNGOLOGY AND OTOLOGY.

Charles W. Richardson, M.D. . . *Professor of Laryngology and Otology*
O. A. M. McKimmie, M.D. . . . . *Clinical Instructor in Laryngology and Otology*
H. S. Dye, M.D. . . . . *Clinical Instructor in Laryngology and Otology*

This course, given in the fourth year, comprises lectures and clinical instruction on diseases of the nasal passages, pharynx, larynx, and also the ear. Practical demonstrations are given in the use of the laryngoscope and other instruments required in these special branches.

Text-books: Kyle's Diseases of the Nose and Throat, Dench's Diseases of the Ear.

OPHTHALMOLOGY.

W. K. Butler, M.D. .... *Professor of Ophthalmology*

A course of lectures on this subject is given in the fourth year. The chief object of the course is to direct attention to the elementary principles of the subject. It is not intended to qualify the student as a specialist. This course is supplemented by clinical instruction.

Text-book: May's Diseases of the Eye.

DERMATOLOGY.

H. C. Yarrow, M.D. .... *Professor of Dermatology*
R. B. Carmichael, M.D. .... *Clinical Professor of Dermatology*

The lectures on this subject are illustrated by diagrams, models, photographic illustrations of disease from life, and also by the exhibition of cases. In connection with the course clinical instruction is given. This subject is taught in the fourth year.

Text-book: Jackson's Diseases of the Skin.

MENTAL DISEASES.

William A. White, M.D. .... *Professor of Mental Diseases*

A series of lectures and clinics is given upon the subject of insanity in its varied forms. This course is given in the fourth year.

Text-book: Kraepelin's Clinical Psychiatry.

Collateral reading: Paton's Psychiatry.

MEDICAL JURISPRUDENCE.

W. C. Woodward, M.D. .... *Professor of Medical Jurisprudence*

This course is given in the third year, and is designed to familiarize students with the rights and obligations of physicians, both legal and ethical, and to qualify them to apply the facts of medical science to the solution of problems in law.

Text-book: Reese's Medical Jurisprudence and Toxicology.

PEDIATRICS.

George N. Acker, A.M., M.D. .... *Professor of Pediatrics*

In the fourth year didactic and clinical lectures are given upon diseases of infants and children and the importance of the proper management of these diseases by diet and hygiene.

Text-book: Holt's Diseases of Infants and Children.

MORBID ANATOMY.

I. W. Blackburn, M.D. . . . . *Professor of Morbid Anatomy*

The instruction in this course will be mainly practical, consisting of post-mortem examinations, demonstrations, and illustrative lectures pertaining to the subjects of morbid anatomy and special pathology. Especial attention will be paid to the study of the gross pathology of diseases of the brain and nervous system. Instruction in the technique of post-mortem examinations for scientific purposes and in medicolegal cases will be a feature of the course. This course will be given during the fourth year.

EXAMINATIONS.

Examinations are held at the end of the course in each subject, and a general examination at the end of the graduating year. Students failing in examination in one major subject or not more than two minor subjects will be permitted to be re-examined at the beginning of the next regular examination period. Students failing in re-examination in a major subject must repeat the subjects in which they do not attain a grade of 80 or more. Students failing to appear at the regular examinations will not be examined until the next regular examination, except by special permission of the Faculty, and in this event an extra fee of $5.00 will be charged. Students failing to pass satisfactorily their practical laboratory examinations will be required to repeat the laboratory courses and pay the regular laboratory fees. Students will not be admitted to examination unless they have paid all fees due at the time or present a permit signed by the Assistant Treasurer. The fall re-examinations for 1905-06 will be held in the Medical Building, September 19, 1905. In order to avail themselves of the privilege of this re-examination students must file their applications with the Dean not later than September 1, 1905.

To be eligible for graduation the student must pass all examinations.

In addition to the foregoing examinations students are required: to dissect satisfactorily one lateral half of the cadaver; to report satisfactorily an analysis of a specimen of urine and a clinical examination of a specimen of blood; to examine and report upon six clinical cases in general medicine and two cases in surgery; to perform satisfactorily two major surgical operations upon the cadaver; to work not less than two weeks in the Dispensary Service of the University or other hospitals; to work not less than two weeks in

the Clinical Laboratory of the University or of some other hospital approved by the Dean; to take charge of one or more obstetrical cases and to report thereon; to examine and report on one case in either ophthalmology, laryngology, otology, dermatology, or orthopedics; to report upon one case in gynecology.

Examinations are written, oral, and practical so far as the nature of the subject permits. The time allowed for written examinations is as follows:

Two hours each for Anatomy, Physiology, Chemistry, Materia Medica and Therapeutics, Histology, Pathology, Bacteriology, Practice, Obstetrics, and Surgery; one hour each for Gynecology, Hygiene, Dermatology, Ophthalmology, Pediatrics, Minor Surgery, Orthopedics, Mental Diseases, Medical Jurisprudence, Nervous Diseases, Otology, Laryngology, and Morbid Anatomy.

For oral examinations such time is allowed as the examiner deems sufficient to test the attainments of the student. For practical examinations in the laboratories one hour is given to each subject.

Examinations are marked upon a scale of 100. A grade of 70 is required to pass an examination.

Every student repeating a year will be required to pay one-half the tuition fee of the academic year. Laboratory fees are required for each year in which laboratory work is done.

Students do not receive their numerical grades, but are notified that they have attained grades A, B, C, D, E, or F, as the case may be. A signifies 96 to 100; B signifies 90 to 95; C signifies 80 to 89; D signifies 70 to 79; E signifies failure; F signifies failed to appear for examination.

REQUIREMENTS FOR DEGREES.

Every candidate for the degree of Doctor of Medicine must be at least twenty-one years of age and of reputable character. He must have complied with the admission examination and other requirements herein set forth. He must file with the Dean, at least 30 days before the dates fixed for conferring of degrees, a notice of his intention to appear for graduation, and he must be present at the time specified for examination, and also at Commencement or Convocation. The degree is not conferred in the absence of a candidate except by special consent of the President's Council. Graduates of other accredited colleges must spend one year in residence at this school, and must pass satisfactory examinations in all subjects in order to receive a diploma.

Candidates who in their work and examinations attain general averages of 80 or more will be presented to the Faculty for consid-

eration with reference to being designated as "having graduated with distinction." If in the opinion of the Faculty such candidates have shown themselves to be possessed of more than ordinary merit, they will have inscribed upon their diplomas beneath their degree the words "with distinction," and the names of such graduates will be distinctively printed at the head of the list of graduates of the year.

Candidates who have completed their courses, but have not passed their final examinations, may take the fall or the winter re-examinations upon payment of a fee of $10, and, if successful, receive their diplomas at the Winter Convocation upon the payment of the diploma fee.

A student who has failed of graduation after repeating his final year will not be permitted to maintain his connection with the school.

COURSES IN ARTS AND SCIENCES.

Students taking a full course for the degree of Doctor of Medicine may, if otherwise qualified, be admitted without additional fee, except laboratory fees, to courses in the Department of Arts and Sciences, provided such courses do not exceed in the aggregate six hours a week.

SCHOLARSHIPS.

Applications for scholarships should be filed with the Registrar of the University not later than September 15. Students holding scholarships pay the matriculation, library, laboratory, and graduation fees, and make the deposit to cover breakage. Holders of scholarships must also maintain a satisfactory scholastic average.

Corcoran Scholarships.—In recognition of the liberality of the late W. W. Corcoran, the University has established in this department six free scholarships.

Two of these scholarships are open for competitive examination to the graduates of the several high schools and the manual training school of the District of Columbia. These two scholarships are awarded to the two students whose averages are highest.

Two of the scholarships are open for competitive examination to graduates of any reputable high school or college who shall give satisfactory written evidence of pecuniary inability and certificates of good moral character and industry. These two scholarships are awarded to the two graduates whose averages are highest.

The remaining two scholarships are open for competitive examination to students who, though not graduates of any high school or college, give satisfactory evidence that they are fitted by previous education for the sudy of medicine, and at the same time give satisfactory written

evidence of pecuniary inability and certificates of good moral character and industry. These two scholarships are awarded to the two students whose averages are highest.

In establishing these averages professional aptitude and general qualifications are considered along with scholastic ability.

MEDICAL MISSIONARY SCHOLARSHIPS.—Two Medical Missionary Scholarships will be given to such applicants as are judged by the President of the University best qualified to enter upon the study of medicine for the purpose of becoming medical missionaries. These scholarships are awarded for one year only, but they may be renewed.

PRIZES.

A general examination prize of $50 is annually awarded to the candidate for graduation who attains the highest average grade in all subjects.

Professor H. C. Yarrow gives a prize for the best examination in Dermatology.

Professor Charles W. Richardson gives a prize for the best examination in Laryngology and Otology.

Professor Acker gives a prize for the best examination in Pediatrics.

Professor Butler gives a prize for the best examination in Ophthalmology.

HOSPITAL APPOINTMENTS.

Three interns are annually appointed in the University Hospital. They are appointed from graduates who have served as externs. Seven externs are also appointed from graduates and from the fourth-year class. In making these appointments scholastic standing and general efficiency and aptitude are considered. Appointments to similar positions are open to the graduates and undergraduates of this school in the following other hospitals of the city: Garfield Memorial Hospital, Emergency Hospital, Columbia Hospital for Women, Casualty Hospital. Providence Hospital, Washington Asylum Hospital, Children's Hospital, Episcopal Eye, Ear, Throat, and Nose Hospital.

CLINICAL FACILITIES.

The following hospitals are open to the students of this school for clinical study:

UNIVERSITY HOSPITAL.—This hospital is a part of the educational equipment of this University, and is intended to be used primarily in

instructing the students in clinical medicine and surgery. It has also in connection with it an out-patient or dispensary service in all departments.

Garfield Memorial Hospital.—This institution has 118 charity beds. Clinics are given regularly throughout the session by members of the Faculty connected with the visiting staff of the hospital. There is also an out-patient department, giving good opportunities for experience in the practice of physical diagnosis.

Children's Hospital.—Regular clinical instruction is given in the medical and surgical wards by members of the Faculty on the visiting staff of the hospital. This institution has 100 charity beds. There is also a large out-patient department.

Emergency Hospital and Central Dispensary.—This hospital has 36 charity beds, and has a very large out-patient service. The large emergency service gives exceptional facilities in clinical surgery. Several members of the Faculty are on its visiting and dispensary staffs and give clinical instruction to the students.

Columbia Hospital for Women.—This hospital has 68 charity beds for diseases peculiar to women and 50 charity maternity beds. Members of the Faculty are connected with its service and use its facilities for clinical instruction.

Providence Hospital.—This institution has a large charity service—100 beds for medical and surgical cases and 130 maternity beds.

The Government Hospital for the Insane.—This hospital is maintained by the United States Government. It has 2,500 beds. Clinical instruction in mental diseases is given by the superintendent of the hospital, who is a member of the Faculty of this school.

Episcopal Eye, Ear, Throat, and Nose Hospital.—Excellent opportunities for clinical instruction in ophthalmology, otology, laryngology, and rhinology are offered by this hospital. Members of the Faculty are on its staff.

Lutheran Eye and Ear Dispensary.—This dispensary affords good opportunities for clinical study of diseases of the eye, ear, throat, and nose. Clinical instruction is given by a member of the Faculty.

Casualty Hospital.—Opportunities in emergency and dispensary work are afforded by this institution.

Location of Hospitals.

University Hospital, H street between Thirteenth and Fourteenth streets, northwest, and adjacent to the Medical Building. Visiting staff: Members of the Faculty of the Department of Medicine.

Garfield Memorial Hospital, Florida avenue and Tenth street, northwest. Members of the Faculty on the visiting staff:
Professor Claytor, Clinical Medicine; Professor Cook, Clinical Medicine; Professor Thompson, Clinical Surgery; Professor Staveley, Clinical Gynecology; Professor Carmichael, Clinical Dermatology; Professor Butler, Clinical Ophthalmology; Professor Hagner, Clinical Genito-Urinary Surgery; Professor Snyder, Clinical Surgery.

Children's Hospital, W street between Twelfth and Thirteenth streets, northwest. Members of the Faculty on the visiting staff:
Professor Thompson, Clinical Surgery; Professor Acker, Clinical Medicine.

Emergency Hospital and Central Dispensary, Fifteenth street and Ohio avenue, northwest. Members of the Faculty on the visiting staff:
Professor Carr, Clinical Surgery; Professor Hagner, Clinical Genito-Urinary Diseases; Dr. Jackson, Clinical Surgery; Dr. Macatee, Clinical Medicine; Professor Carmichael, Clinical Dermatology; Dr. Miller, Clinical Gynecology; Dr. Le Merle, Clinical Nervous Diseases.

Columbia Hospital for Women, Twenty-fifth street and Pennsylvania avenue, northwest. Members of the Faculty on the visiting staff:
Professor Bovee, Clinical Gynecology; Professor Cabell and Professor Morse, Clinical Obstetrics.

Providence Hospital, Second and D streets, southeast. Members of the Faculty on the visiting staff:
Professor Bovee, Clinical Gynecology; Professor Shute, Clinical Ophthalmology.

Episcopal Eye, Ear, Throat, and Nose Hospital, Fifteenth street between L and M streets, northwest. Members of the Faculty on the visiting staff:
Professor Richardson, Clinical Otology and Laryngology; Dr. McKimmie and Dr. Dye, Clinical Otology and Laryngology.

Lutheran Dispensary, Fourteenth and N streets, northwest. Member of the Faculty on the visiting staff:
Professor Butler, Clinical Ophthalmology.

Government Hospital for Insane, Anacostia, D. C. Members of the Faculty on the visiting staff:

Professor White, Mental Diseases; Professor Clarke, Nervous Diseases.

Casualty Hospital, Massachusetts avenue, northeast. Members of the Faculty on the visiting staff:

Professor Wellington, Clinical Surgery; Dr. Frankland, Clinical Gynecology; Dr. Noble P. Barnes, Clinical Medicine.

LABORATORIES.

The different laboratories of the Department are all modern and equipped with the necessary apparatus for thorough work.

Pathological Museum.

A great many valuable and interesting specimens are contained in the Pathological Museum of this school. Their number is increased by additions from time to time. These specimens are particularly valuable to the students as illustrating the changes produced by disease.

Other Museums.

The Army Medical Museum affords an unrivaled opportunity for studying the conditions met with in military surgery. It contains on exhibition a collection of anatomical and pathological specimens unequaled by any other museum. Other Government museums are the Museum of Hygiene, in connection with the Medical Department of the Navy. The National Museum contains the most complete and best arranged collection of materia medica in the world. The drugs are shown in all their processes of manufacture. The Botanic Gardens, the Smithsonian Institution, the Fish Commission, the Department of Agriculture all afford opportunities for study both in medicine and its collateral sciences.

THE MEDICAL DEPARTMENT LIBRARY.

The Medical Library is open for study and consultation from 9 a. m. to 10.30 p. m. It contains at present more than 1,400 volumes, and provision is made in the annual library fee charged every student to add to it as published the important new works on medicine. As the library stands at present, it is an excellent working collection for the medical student.

OTHER LIBRARIES.

Washington contains the Library of the Surgeon General's office of the United States Army, the most complete medical library in the world. This library, as all other libraries of the Government, is open to the public between the hours of 9 a. m. and 4.30 p. m. There is also the Library of Congress and the many excellent libraries of the various other Government offices.

FEES AND CONTINGENT EXPENSES.

1. Matriculation fee (payable only on first entry into the University) $5.00
2. Library fee per annum 2.00
3. Tuition fee per annum, including all charges for materials 150.00
4. Fee for graduation 10.00

A deposit of $5 per annum is required of every student to cover loss, breakage, or damage to the property of the school. The amount of such deposit paid in excess of the breakage will be returned.

5. Tuition fees per annum for special courses are noted on page 137, paragraph 6.

In addition to the tuition fees for special laboratory courses a charge will be made for materials used.

6. Tuition fee per annum for any year repeated once, or for a fifth year 75.00

In addition to the tuition for a repeat year a charge will be made for materials used in laboratory courses repeated.

7. Fee for a certificate under the seal of the University.... 2.00
8. Auditors are admitted to lecture courses for the regular tuition fees, but are not permitted to take active part in the work of the classes, and will not be allowed credit, in a subsequent course of studies leading to a degree, for attendance as auditors. No matriculation or library fee is charged.

No change will be made in the fees fixed at registration except in case of withdrawal, and then only upon notice in due form, and from the end of the current quarter session, when such withdrawal shall be approved. Applications for the granting of a withdrawal

should be made on the prescribed form to be obtained from the Registrar, and will be received only at the end of a quarter session.

Students are urged to purchase their own microscopes, but those who do not care to do so may rent them from the University at the following rates:

Microscope for Histological Laboratory use	$3.00
Microscope for Bacteriological, Pathological, and Clinical Microscopy Laboratory use	5.00

PAYMENT OF FEES.

All fees are to be paid to the Assistant Treasurer. Tuition fees are payable quarterly, in advance. Matriculation, library and laboratory fees are payable in full, in advance.

BOARD AND ROOMS.

The price of table board and rooms varies according to locality. Good accommodations may be secured at some distance from the University buildings for two hundred dollars for the session of thirty-three weeks. In the neighborhood adjacent to the University, by reason of its nearness to the heart of the best business section of the city, prices range from two hundred and fifty to three hundred and fifty dollars for the session of thirty-three weeks. Students frequently form clubs for the purpose of obtaining a reduction in the cost of living. A register of approved boarding-houses is kept by the Assistant Treasurer, who will gladly furnish information in relation thereto, or in connection with any other matters looking to the comfort of students seeking a residence in the city of Washington.

For catalogues, application blanks and further information address

THE REGISTRAR,
The George Washington University,
Washington, D. C.

Department of Medicine.

II. FACULTY OF DENTISTRY.

Charles Willis Needham, LL.D........President of the University
J. Hall Lewis, D.D.S.......Dean and Professor of Dental Prosthetics
Henry C. Thompson, D.D.S..........Professor of Operative Dentistry
D. Kerfoot Shute, A.B., M.D..................Professor of Anatomy
William P. Carr, M.D......................Professor of Physiology
Charles E. Munroe, Ph.D....................Professor of Chemistry
Thomas A. Claytor, M.D...............Professor of Materia Medica and Therapeutics
Jonathan R. Hagan, D.D.S................Professor of Oral Surgery
John B. Nichols, M.D........................Professor of Histology
James Carroll, M.D.........Professor of Bacteriology and Pathology
J. Roland Walton, D.D.S...........Professor of Prosthetic Technics
J. H. P. Benson, D.D.S................Professor of Operative Technics
E. G. Seibert, M.D...................Assistant Professor of Chemistry
W. F. R. Phillips, M.D......Assistant Professor of Practical Anatomy
William H. Trail, D.D.S......Assistant Professor of Materia Medica
D. Webster Prentiss, M.D...........Assistant Professor of Histology
L. H. Taylor, M.D................Assistant Professor of Physiology
Noble P. Barnes, M.D...................Lecturer on Materia Medica
S. H. Greene, Jr., M.D........................Instructor in Anatomy
J. L. Riggles, M.D............................Instructor in Anatomy
George M. Ruffin, M.D......................Instructor in Anatomy
Otis D. Swett, B.S..........................Instructor in Chemistry
Harry H. Donnally, M.D.........Assistant Instructor in Bacteriology
Charles Bassett, D.D.S...............Demonstrator in Charge of the Dental Infirmary
Huron W. Lawson, M.D..........Assistant Demonstrator of Anatomy
George B. Heinecke, M.D.........Assistant Demonstrator of Anatomy
Virgil B. Jackson, M.D...........Assistant Demonstrator of Anatomy
Edward Elliott Richardson, M.S., M.D.......Assistant Demonstrator of Anatomy
W. A. Frankland, M.D...........Assistant Demonstrator of Anatomy
R. M. Little, M.D................Assistant Demonstrator of Anatomy
Joseph D. Rodgers, M.D...........Assistant Demonstrator of Anatomy
Elmer Slayton Newton, B.A., M.D............Assistant in Chemistry
Arthur N. Tasker, B.A......................Assistant in Chemistry

C. L. Davis, M.D. .... Assistant Instructor in Histology
Henry M. Jewett, M.D. .... Assistant Instructor in Histology
Charles L. Bovee, D.D.S. .... Demonstrator in the Dental Infirmary
Cadmus Linden Odor, D.D.S. ..... Demonstrator of Operative Technics
Joseph Wood Pollock, D.D.S. . Assistant Demonstrator in the Infirmary
Arthur Millard Trivett, D.D.S. .... Assistant Demonstrator in the Infirmary
Thomas R. Wilkerson, D.D.S. .... Assistant Demonstrator in the Infirmary

GENERAL STATEMENT.

The first course of lectures in the Dental School began November, 1887, under the title of "The Columbian University Dental Department." The course then extended over two years of five months each. Two years later the course was extended to seven months; but, this additional time being found inadequate to keep pace with the ever increasing demand for higher dental education, the course was gradually increased, until now it extends over three years of eight months each.

The academic year begins on the last Wednesday in September and ends on the first Wednesday in June. The next session will begin September 26, 1906, and end June 7, 1907. Students should register promptly at the office of the Registrar at the beginning of the session, and no student can be received and credited with a full term after ten days from the first lecture. Final examinations are held at the conclusion of the instruction in each subject. The degrees are conferred at Commencement, the first Wednesday in June, and at the Winter Convocation, February 22. For further information communicate with the Dean of the Dental Department or the Registrar of the University.

ADMISSION.

Candidates for matriculation must show that they are fitted by previous education to study dentistry. For this purpose they must present a satisfactory certificate of their attainments from an approved school or college, or they must pass an examination.

Candidates are admitted without examination:

(1) Upon presenting a diploma or certificate of a reputable college conferring on them the degree of A.B. or B.S., or an equivalent degree in the arts and sciences.

(2) Upon presenting a diploma or certificate of graduation from a high school, academy, or preparatory school approved by the University as maintaining an adequate standard.

(3) Upon presenting a certificate of admission to the freshman class of an approved college.

(4) Upon presenting a dental student's certificate issued by a State board.

(5) Upon presenting a certificate of admission to another dental school approved by the University as maintaining an adequate standard.

Candidates unable to comply with the foregoing requirements are admitted upon passing an examination based upon the general requirement for admission to colleges, which is a four-year high-school course, or its equivalent, modified to meet the regulations of State Dental Boards. This examination comprises subjects selected from the annexed list equal to 15 units. For admission to the regular course in Dentistry eight (8) of the 15 units are required in the following subjects.

	Units.
English	3
Mathematics	3
Physics	1
Latin	1
Total	8

The other 7 units may be selected from the other subjects. A unit is considered the equivalent of one year's high-school work in a subject.

LIST OF SUBJECTS.

English:	Units.
(*a*) Grammar	1
(*b*) Rhetoric and Composition	1
(*c*) Literature—a knowledge of the form, subject-matter, and literary history of prescribed works is required	1

The following are the works prescribed for 1906-07: Burke's Speech on Conciliation, Macaulay's Essay on Addison, Macaulay's Essay on Milton, Milton's L'Allegro, Il Penseroso, Comus, and Lycidas: Shakespeare's Macbeth. Equivalent reading may be offered.

Latin:	
(*a*) Elementary Grammar	1
(*b*) Cæsar's Commentaries, Books I-IV	1

Greek:	
(*a*) Elementary Grammar	1
(*b*) Xenophon or Homer	1
Modern Languages:	
(*a*) French, translation of easy prose	1
(*b*) German, translation of easy prose	1
History:	
United States	1
English	1
Greek and Roman	1
General	1
Mathematics:	
(*a*) Algebra through quadratics	1½
(*b*) Plane Geometry	1
(*c*) Plane Trigonometry	½
Sciences:	
Physics	1
Chemistry	1
Astronomy	½
Biology	1
Geology	½
Botany	1
Physical Geography	½
Physiology	½

The scope of the different subjects is indicated in standard high-school text-books.

Candidates may offer other subjects than those stated in the foregoing list of subjects, and if they are acceptable examinations will be arranged. A candidate may offer certificates of an approved school for work done in any of the foregoing subjects, and will be credited with the units represented by such work. A candidate failing to pass in two of the subjects of his examination may be admitted to the first year upon the condition that he make up the deficiency before entering the Second-year Class. The examinations are conducted by examiners appointed by the Superintendent of Schools of the District of Columbia.

The examinations for admission will be held in June and September, at the Dental Department. An applicant deficient in either Latin or Physics, or both, may be admitted to the First-year Class conditioned in those subjects, but such conditions must be made up during the first year.

COURSE OF INSTRUCTION.

The course of instruction extends through three years of eight months each. The subjects taught during the course are divided as follows:

First year.	Second year.	Third year.
Anatomy.	Operative Dentistry.	Operative Dentistry.
Physiology.	Prosthetic Dentistry.	Prosthetic Dentistry.
Chemistry.	Pathology.	Oral Surgery.
Histology.	Materia Medica.	Orthodontia Technics.
Operative Technics.	Therapeutics.	Operative Technics.
Prosthetic Technics.	Operative Technics.	Prosthetic Technics.
	Prosthetic Technics.	Infirmary Practice.
	Infirmary Practice.	Bacteriology.
		Dental Therapeutics.

These studies are further described in the following pages.

PROSTHETIC DENTISTRY AND METALLURGY.

J. Hall Lewis, D.D.S. .... *Professor*

In this subject the principles involved in the construction of artificial substitutes are exhaustively considered and the lectures supplemented by practical demonstrations of the subjects mentioned. In addition to the more commonly used vegetable bases for artificial teeth, the use of gold, silver, and platinum is thoroughly taught, and bridge work and the construction of appliances for correcting oral irregularities, etc., are carefully considered. The modes of preparation, properties, etc., of the metals and alloys of particular interest to the dentist receive special attention.

The instruction is thoroughly practical, with the purpose of preparing the student for the actual every-day practice of prosthetic dentistry.

OPERATIVE DENTISTRY, DENTAL ANATOMY AND PATHOLOGY.

Henry C. Thompson, D.D.S. . . . . *Professor*

This course embraces lectures on the special anatomy and physiology of the teeth. The origin, growth, and eruption of the teeth receive minute attention, and are illustrated as their importance demands.

The methods of treating, filling, and extracting teeth receive attention in the lecture-room, and are demonstrated clinically by proficient operators. Extended consideration is given to dental pathology and therapeutics.

CHEMISTRY.

Charles E. Munroe, Ph.D. . . . . *Professor*
E. G. Seibert, M.D. . . . . *Assistant Professor*
Otis D. Swett, B.S. . . . . *Instructor*
Elmer S. Newton, B.A., M.D. . . . . *Assistant*
Arthur N. Tasker, B.A. . . . . *Assistant*

The instruction in this subject embraces:

A short discussion of the principles of Physics in their relation to Chemistry, the principles of chemical philosophy, and the laws of chemical combination.

A study of the elements, metallic and non-metallic; the preparation, properties, and reaction of their different compounds and their application in dentistry; Organic Chemistry, with special attention to those organic compounds that are of practical use; laboratory instruction in the determination of acids and bases, analyses of alloys, etc.

PHYSIOLOGY.

W. P. Carr, M.D. . . . . *Professor*
L. H. Taylor, M.D. . . . . *Assistant Professor*

The subject is fully covered the first year by a course of lectures, and these lectures are so illustrated by modern diagrams, models, and experiments as to make them clear in detail. Emphasis is given to principles that have a known practical value.

MATERIA MEDICA AND THERAPEUTICS.

Thomas A. Claytor, M.D. ....*Professor*
Wm. H. Trail, D.D.S. ....*Assistant Professor*
Noble P. Barnes, M.D. ....*Lecturer on Materia Medica*

Instruction in this subject extends through the first two years, and embraces:

The study of crude drugs and their preparations and the art of prescribing; the physiological action of drugs in the human system; the practical application of drugs and other therapeutical agencies to the prevention and cure of diseases and the relief of suffering, together with their antidotal relations to poisons.

The subject is taught by means of lectures, recitations, and blackboard illustrations, and is made practical to as great a degree as is compatible with a sufficiently thorough understanding of its principles.

In connection with this chair is a pharmaceutical laboratory, well equipped with modern appliances, in which are taught the making of typical preparations of the Pharmacopœia, prescription writing, and the compounding of prescriptions.

ANATOMY.

D. Kerfoot Shute, A.B., M.D. ....*Professor*
W. F. R. Phillips, M.D. ....*Assistant Professor*
Geo. B. Heinecke, M.D. ....*Assistant Demonstrator*
Virgil B. Jackson, M.D. ....*Assistant Demonstrator*
E. E. Richardson, M.D., M.S. ....*Assistant Demonstrator*
W. A. Frankland, M.D. ....*Assistant Demonstrator*
S. H. Greene, Jr., M.D. ....*Instructor*
J. L. Riggles, M.D. ....*Instructor*
R. M. Little, M.D. ....*Assistant Demonstrator*
Geo. M. Ruffin, M.D. ....*Instructor*
Jos. D. Rodgers, M.D. ....*Assistant Demonstrator*

The instruction in Anatomy is given in a graded course of lectures, recitations from prescribed text-books, and especially by practical work in the dissection of the cadaver. The lectures are illustrated by the use of dry and wet dissections of the cadaver, by models, diagrams, charts, and sciopticon views.

Practical work in osteology and in dissection of the head are of fundamental importance. For the study of these subjects the class is divided into sections in order to make the instruction as practical as possible. The bones of the skeleton are placed in each student's hands, and he is instructed and quizzed upon all their important features.

ORAL SURGERY.

J. R. Hagan, D.D.S. .... *Professor*

This subject includes lectures on general surgery, surgical bacteriology, inflammations, abscess, gangrene and necrosis, the reduction of luxations and fractures and all the latest appliances for their proper retention; diagnosis and treatment of the maxillary sinus, plastic operations for correction of cleft palate and hare lip, treatment of wounds, shock and collapse; also the origin, classification, growth and removal of tumors of the face, mouth and jaw.

HISTOLOGY.

John B. Nichols, M.D. .... *Professor*
D. Webster Prentiss, M.D. .... *Assistant Professor*
Henry M. Jewett, M.D. .... *Assistant Instructor*
C. L. Davis, M.D. .... *Assistant Instructor*

The course in Histology consists in a systematic presentation of the subject of the minute anatomy of the various parts of the body, especial attention being devoted to the histology of the teeth and neighboring structures. The subject is presented partly by systematic lectures, and more especially by the practical study by the individual students of actual specimens under the microscope. The methods of preparation of microscopical specimens are presented and practiced in the laboratory. The projection microscope, affording valuable aid in illustrating and presenting the subject, is constantly used.

BACTERIOLOGY.

James Carroll, M.D. .... *Professor*
Harry H. Donnally, M.D. .... *Assistant Instructor*

The course begins with a consideration of the principles involved in the process of sterilization by dry and moist heat, the relative value and mode of application of each, and an explanation of the construction of the apparatus employed for the purpose. The use and construction of the thermostat is taken up at the same time and the student taught how he can dispense with these costly appliances in emergencies.

The composition and modes of preparation of the various nutritive media are next considered, working formulas given, and the students required to prepare them at least once in the laboratory.

This is followed by a discussion of bacteria as a class, their position in the biological world, their classification, distribution, and the general and special characters that belong to them.

After this preparatory training the various methods in use for the isolation and study of bacteria are taught by practical demonstration and practiced by the students, after which the most important pyrogenic organisms are studied in detail, giving special attention to those found in the nasal and oral cavities.

The aim of the course is chiefly to afford the students an opportunity to become practically familiar with bacteriological working methods, and to enable them to isolate and identify the bacteria present in suppurative processes, as well as to comprehend intelligently the references to micro-organisms in the current professional literature of the day.

OPERATIVE TECHNICS.

J. H. P. Benson, D.D.S. . . . . *Professor*
Cadmus L. Odor, D.D.S. . . . . *Assistant*

This subject is taught by lectures, illustrated by enlarged models and drawings, together with demonstrations of instruments and materials. The students perform exercises in manipulative procedure under the direction of the instructors.

The subjects embraced in the course consist, first, of the study of dental nomenclature, that the student may acquire an understanding of the technical terms used in the course of his dental studies. This is followed by descriptive dental anatomy and the forms and surface markings of each tooth studied, the natural teeth, as well as enlarged models and drawings, being used for the purpose. Each student is required to make various sections of the teeth for the thorough study of the pulp chambers and root canals and their relations to the external surfaces of the teeth.

That tooth-forms may be more perfectly impressed upon the mind of the students, each one is required to carve a tooth of the several classes, as incisor, cuspid, bicuspid, and molar, in bone or artificial ivory, representing the actual form and size of the natural organ. Cavities are classified and illustrated by drawings and models, followed by their preparation and filling in technic forms by the student. Treating and filling root canals is given full attention, the students performing operations of this kind upon natural teeth mounted for the purpose.

All work, in its relation to operative dentistry, is given the necessary consideration to fit the student for meeting, as far as possible,

the actual requirements of the infirmary. The operations in the technic department require a large number of natural teeth and a sufficient supply is difficult to obtain. It will therefore be to the interest of students if they will bring with them all the extracted teeth they can procure.

ORTHODONTIA.

J. Roland Walton, D.D.S. .... *Professor*
Charles Bassett, D.D.S. .... *Instructor*

Orthodontia is taught by lectures and practical work in the Infirmary.

Junior year Orthodontia is a technical course with such lectures and demonstrations as will enable the student to perform the Infirmary work. The senior year is a review of the junior studies with advanced lectures upon the irregularities of the teeth, local and constitutional. Each student is required to make a number of appliances upon models and practically correct cases of irregularity.

CROWN AND BRIDGE WORK.

Charles L. Bovee, D.D.S. .... *Instructor Senior Class*
Allen S. Wolfe, D.D.S. .... *Instructor Junior Class*
Frederick I. Bartlett, D.D.S. .... *Instructor Freshman Class*

Instruction in this course is systematically given by lectures and clinics. The course in technique extends through the freshman, junior and senior years.

PROSTHETIC TECHNICS.

Charles L. Bovee, D.D.S. .... *Instructor Senior Year*
Allen S. Wolfe, D.D.S. .... *Instructor Junior Year*
Frederick I. Bartlett, D.D.S. .... *Instructor Freshman Year*

The technic laboratories are thoroughly equipped for their particular work. The course in prosthetic technics extends through the freshman, junior and senior years.

The first year is a technical course. The students are taught the proper equipment of a dental laboratory; the preparation of the mouth for dentures; methods of taking impressions of the mouth and manipulation of the various impression materials; the prepa-

ration and mounting of models; selection and artistic arrangement of teeth; the construction of plastic dentures with general details.

In the junior class the course is a review of the freshman year with extended technical work, embracing a practical course in the swaging of the various metals, as taking impressions, making models and dies, swaging, rimming, attaching teeth by rubber, and in general construction of metal dentures, crown and bridge work.

The senior year is a practical course, embracing the swaging of plates, teeth attached by soldering, clasps, porcelain work, advanced bridge-work, removable bridges, and the detailed construction of all work in prosthetic dentistry.

PORCELAIN WORK.

Howard P. Cobey, D.D.S. .... *Instructor*

Students are taught the principles and practice of inlay work, porcelain crowns, high and low fusing bodies, the use of the electric and gas furnaces.

THE DENTAL INFIRMARY.

Charles Bassett, D.D.S. .... *Demonstrator in Charge*
Charles L. Bovée, D.D.S. .... *Demonstrator*
Joseph Wood Pollock, D.D.S. .... *Demonstrator*
Arthur Millard Trivett, D.D.S. .... *Demonstrator*
Thomas R. Wilkerson, D.D.S. .... *Demonstrator*

The Infirmary is open every week day for nine continuous months (being closed during the months of July, August, and September), during which time an abundance of clinical material is readily available. In fact, as many patients present themselves as can possibly be attended to by the students. It is under the immediate supervision of the Demonstrator in charge, who is present from 1 until 6 o'clock each week day.

TEXT-BOOKS AND WORKS OF REFERENCE.

(The works first named and in *italics* are preferred.)

Anatomy.—*Cunningham's Text-Book of Anatomy; Cunningham's Manual of Practical Anatomy;* Dental Anatomy, Black's.
Physiology.—Raymond's Human Physiology.
Chemistry.—*Simon's Chemistry.*

Materia Medica.—*H. C. Wood's Therapeutics;* Hare's Practical Therapeutics; A. A. Stevens' Modern Materia Medica and Therapeutics; Culbreth's Materia Medica and Pharmacy; National Dispensatory.

Prosthetic Dentistry.—*The American Text-Book of Prosthetic Dentistry;* Essig's Dental Metallurgy.

Operative Dentistry.—*Harris' Principles of Practice;* Tome's Dental Anatomy and Surgery; Taft's Operative Dentistry; American System of Dentistry—Litch.

Oral Surgery.—Marshall's Oral Surgery; Grant's Oral Surgery.

Histology.—Nichols, Böhm and Davidoff.

Orthodontia.—Talbot, Irregularities of the Teeth; Angle, Treatment of Malocclusion of the Teeth and Fractures of the Maxillæ; Jackson, Orthodontia.

GRADUATION.

Candidates for graduation must have attended three full courses of lectures, each of eight months duration, and three courses of clinical instruction in this Department, during the regular winter term and in separate years. Students are examined at the end of the regular course upon all subjects taught them during that course. Should the student fail in his examination in course, he may be re-examined in the fall. All fees must be paid and Infirmary requirements complied with before the student may present himself for examination.

Students must enter before, or within ten days after, the opening lecture of the regular course. They may register at any time during the nine months Infirmary course, and thus begin Infirmary practice at once upon payment of twenty-five dollars, which amount will be deducted from their tuition fees for the succeeding regular term.

The candidate for graduation must be examined upon all subjects taught in this Department, and before the examination he must perform operations upon the natural organs in the Infirmary, and present the Museum a well-constructed specimen of dental mechanism made by himself in the dental laboratory of the University.

In addition to the above requirements, the moral character and habits of the candidate, his industry, and diligent attendance will be taken into consideration. Notable negligence, immorality, or habitual absence from the lectures will preclude the candidate from attaining his degree, even though he may have acquired sufficient technical knowledge to pass a creditable examination. This reservation on the part of the Faculty of the right to make good moral character a prerequisite for graduation must not be overlooked.

The student also, during and between the sessions, must comply with the State laws regulating the practice of Dentistry, and act in accordance with the recognized code of ethics of the dental profession.

The degrees are conferred by The George Washington University, incorporated by Act of Congress of the United States.

PRIZES.

Faculty Prize.—A prize will be given by the Faculty to the graduate passing the best examination in all branches and having the best Infirmary record.

COURSES IN ARTS AND SCIENCES.

Students taking a full course for a degree may be admitted without additional fee, except laboratory fees, to courses for which they are qualified, in the Department of Arts and Sciences, the aggregate of such courses not to exceed six hours per week.

LOCATION.

The Dental Building is No. 1325 H Street, N. W. It is within half a square of all lines of street cars going to every part of the city.

The Dean may be seen personally at 1121 Vermont avenue on any week day from 3 to 4 p. m., and also at the Dental Building, 1325 H Street, N. W., on Monday, Wednesday, and Friday of each week at 4 p. m.

FEES AND CONTINGENT EXPENSES.

1. Matriculation fee (payable only on first entry into the University)	$5
2. Library fee per annum	2
3. Tuition fee per annum, including all charges for materials	150
A deposit of $5 per annum is required of every student to cover loss, breakage or damage to the property of the school. The amount of such deposit paid in excess of the breakage will be returned.	
4. Fee for graduation with diploma	10

5. Tuition fees per annum for special courses are noted on page 137, paragraph 6. In addition to the tuition fees for special laboratory courses a charge will be made for material used.
6. Tuition fee per annum for any year repeated once 75
   In addition to the tuition for a repeat year a charge will be made for materials used in laboratory courses repeated.
7. Fee for a certificate under the seal of the University 2
8. Auditors are admitted to lecture courses for the regular tuition fees, but are not permitted to take active part in the work of the classes and will not be allowed credit, in a subsequent course of studies leading to a degree, for attendance as auditors. No matriculation or library fee is charged.

No change will be made in the fees fixed at registration except in case of withdrawal, and then only upon notice in due form and from the end of the current quarter session when such withdrawal shall be approved. Applications for the granting of a withdrawal should be made on the prescribed form, to be obtained from the Registrar, and will only be received at the end of a quarter session.

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Microscope for Histological Laboratory use 3
Microscope for bacteriological, pathological, and clinical microscopy laboratory use 5

PAYMENT OF FEES.

All fees are to be paid to the Assistant Treasurer. Tuition fees are payable quarterly, in advance. Matriculation, library, and laboratory fees are payable in full, in advance.

BOARD AND ROOMS.

The price of table board and rooms varies according to locality. Good accommodations may be secured at some distance from the University buildings for two hundred dollars for the session of thirty-three weeks. In the neighborhood adjacent to the University, by reason of its nearness to the heart of the best business section of the city, prices range from two hundred and fifty to three hundred and fifty dollars for the session of thirty-three weeks. Students frequently form clubs for the purpose of obtaining a re-

duction in the cost of living. A register of approved boarding-houses is kept by the Assistant Treasurer, who will gladly furnish information in relation thereto, or in connection with any other matters looking to the comfort of students seeking a residence in the city of Washington.

For catalogues, application blanks, and further information, address

THE REGISTRAR,
The George Washington University,
Washington, D. C.

DEPARTMENT OF LAW AND JURISPRUDENCE.

FACULTY.

CHARLES WILLIS NEEDHAM, LL.D.,.......PRESIDENT OF THE UNIVERSITY
WILLIAM REYNOLDS VANCE, Ph.D., LL.B......Dean of the Faculty and Professor of Law
WILLIAM A. MAURY, LL.D.......................Professor of Law
JOHN M. HARLAN, LL.D..........................Professor of Law
DAVID J. BREWER, LL.D..........................Professor of Law
WILLIAM G. JOHNSON, LL.M......................Professor of Law
MELVILLE CHURCH, LL.M............Professor of the Law of Patents
WALTER C. CLEPHANE, LL.M......................Professor of Law
EDWIN C. BRANDENBURG, LL.M....................Professor of Law
ARTHUR PETER, LL.M............................Professor of Law
HENRY P. BLAIR, LL.M..........................Professor of Law
STANTON J. PEELLE, LL.D.......................Professor of Law
JOHN PAUL EARNEST, A.M., LL.M.................Professor of Law
HANNIS TAYLOR, LL.D...........................Professor of Law
ERNEST G. LORENZEN, Ph.B., LL.B., J.U.D.......Professor of Law
GEORGE WINFIELD SCOTT, LL.B., Ph. D...........Professor of Law
JAMES BROWN SCOTT, M.A., J.U.D................Professor of Law
ALFRED NERINCX, LL.D..........................Professor of Law
CARL HAU, M.A., LL.B..................Assistant Professor of Law
ROBERT M. HUGHES, A.M., LL.B......Lecturer on Admiralty Law and Procedure
CHARLES H. DUELL, A.B., LL.B....Lecturer on Substantive Patent Law
JOHN WILMER LATIMER, LL.B..............Clerk of the Moot Court
OTIS D. SWETT, B.S., LL.M..............................Secretary

GENERAL STATEMENT.

This Department, established in 1865, is the oldest school of law in the city of Washington. Its course of instruction for the degree of Bachelor of Laws, originally requiring but two years, was gradually expanded, until, in 1898, in accordance with the recommendation of the Association of American Law Schools, it was increased to three years. The Faculty has also shown a gradual increase in numbers commensurate with the expansion of the course and the growing number of students in attendance. In June,

1903, the Board of Trustees adopted the policy of putting the fundamental subjects of substantive law in charge of permanent professors, devoting their whole time and energy to the work of the Department.

In 1877 a year of graduate work, leading to the degree of Master of Laws, was added to the course of instruction offered. A special course in Patent Law was added in 1895.

In June, 1898, an ordinance was adopted by the Board of Trustees formally establishing as a separate department of the University the Department of Jurisprudence and Diplomacy. This Department was opened with appropriate ceremonies on November 15, 1898.

In 1904, by the authority of the Board of Trustees, a new adjustment of graduate work in the University was made, resulting in the establishment of the Departments of Law and Jurisprudence, and of Politics and Diplomacy, the former embracing the undergraduate course in municipal law and graduate courses in the broader fields of general law, and the latter certain graduate courses in the realm of political science, special attention being given to diplomacy.

LOCATION.

All classes in both the Department of Law and Jurisprudence and that of Politics and Diplomacy are held in Law Lecture Hall, situated on H street, adjoining the main University building, at the corner of Fifteenth street. This hall, dedicated on January 3, 1899, was especially designed for the work of these Departments. It is commodious and well equipped with lecture-rooms, Moot Court rooms and offices, and contains a large library, with a conference-room adjoining.

ACADEMIC YEAR.

The academic year extends through more than eight months, beginning on the last Wednesday in September and ending on the first Wednesday in June, and is divided into two half-years, the second half-year beginning on the first day of February. Since all courses given during the first half-year are completed before the beginning of the second half-year, it is possible for a student to enter on the 1st of February of any year and be graduated three years from that date, receiving his degree at the Winter Convocation, held on February 22d of each year.

ADMISSION.

1. For the Degree of Bachelor of Laws.

Applicants for admission as candidates for the degree of Bachelor of Laws must be at least eighteen years of age and must have had educational training equivalent to a course in an approved high school. The educational requirement may be satisfied by presentation of certificates or by examinations in the usual high school branches. These examinations will be held September 17-21. All applications for admission should be addressed to the Registrar of the University, who will furnish proper blanks upon request.

Admission Requirements After September First, 1909.—After September 1st, 1909, no student will be admitted to regular standing unless he shall have successfully completed two years of undergraduate work in an approved college. Applicants who have completed a high-school course may, however, at the discretion of the Faculty, be admitted as special students. Such special students may qualify for graduation by showing an average grade during the entire course exceeding the passing grade by twenty per cent.

2. For the Degree of Master of Laws.

Candidates for the degree of Master of Laws must be at least twenty-one years of age and hold the degree of Bachelor of Laws from an institution of approved standing.

3. For the Degree of Master of Patent Law.

Only those students who are graduates of an approved law school or members of the bar in good standing will be admitted as candidates for the degree of Master of Patent Law.

4. For the Degree of Doctor of Jurisprudence.

No student will be admitted as a candidate for the degree of Doctor of Jurisprudence unless he shall hold a baccalaureate degree conferred by some institution of approved standing after the completion of a liberal course of undergraduate academic study, and possess a reading knowledge of Latin, French, and German. At the discretion of the Faculty, however, other languages may be substituted when the character of the work undertaken is such as to warrant it. The right is reserved to the President's Council to decide in all cases whether the applicant has given sufficient evidence that his antecedent training fulfils these requirements. In addition, the candidate must hold the degree of Bachelor of Laws from this University or from some other institution requiring equivalent work as a prerequisite to that degree.

5. Special Students.

Persons who for any reason do not qualify as candidates for a degree may, on the recommendation of the Faculty and with the assent of the professors whose courses they elect to take, be admitted as special students. Special students may subsequently be admitted to regular standing in any of the classes upon satisfying the requirements of admission thereto.

ADVANCED STANDING.

Students may be admitted to advanced standing in the second or third year classes upon satisfying the requirements for the work of the preceding year or years. These requirements may be met by presenting certificates from other law schools of accredited standing showing that the student has successfully completed equivalent courses, or by passing the regular examinations set for that purpose at the beginning of the term, after showing that he has pursued a course of study in the subjects upon which he is examined covering at least as many hours as are required for such subjects in this University.

Attorneys in good and regular standing who have been admitted to practice in any State requiring an examination for admission to the bar may be admitted to advanced standing in the second or third year class, at the discretion of the Dean.

All examinations that may be required of applicants for advanced standing are held during the first week of each session.

HOURS FOR LECTURES.

While in former years instruction has been given in the morning hours, yet heretofore the lectures on all required subjects have been held between 4.50 and 6.30 in the afternoon. Beginning with the session of 1906-07, only nine of the fifteen hours that will be given to the first year class will be in the afternoon, the remaining hours being in the forenoon. During the session of 1907-08 the exercises of the second year class will also be held in accordance with the same schedule, which will, during the following session, be extended to the subjects offered to the third year class.

METHOD OF INSTRUCTION.

Instruction is based upon the study and discussion of selected cases, in connection with which assignments may be made from

approved text-books when the nature of the subject is such as to make it advisable. In conducting the discussion of cases in the class-room every effort is made to lead the student to a clear understanding of the fundamental legal principles that may be involved, and to afford him scientific training in accurate methods of study and of reasoning along legal lines. Students are also required to submit written briefs upon doubtful points of law, to draw up contracts, conveyances, and other papers when the nature of the subject in hand is such as to make exercises of this kind useful in giving accurate instruction.

All subjects involving the adjective law are in charge of professors who are also engaged in active practice. The general principles of these subjects, taught in the same manner as indicated above, are developed by practice before the Moot Courts.

UNDERGRADUATE PROFESSIONAL COURSES.

Undergraduate students in Columbian College upon the completion of forty-five units of credit may take the first year's work of the course for Bachelor of Laws, crediting them fifteen units in the College, on the completion of which they may receive the College degree.

COURSES OF INSTRUCTION.

A. Leading to the Degree of Bachelor of Laws.

The course of instruction leading to the degree of Bachelor of Laws extends through a period of three years. A minimum of thirty-six hours' work will be required of all students hereafter entering the Department, students already registered being permitted to qualify for their degrees upon the completion of the courses as heretofore required. These include twelve hours of work each week for the first and second year classes, and ten hours for the third year class. By means of the courses as arranged, it is intended to give to the student such sound training in the fundamental principles of English and American law as will fit him for the practice of the legal profession in any of the States or Territories of the United States.

FIRST YEAR.

First Half-Year.

Contracts. Four hours. Professor VANCE.
Criminal Law. Three hours. Professor EARNEST.
The Law of Persons. Two hours. Professor BLAIR.
Constitutional Law. Two hours. Professor HARLAN.
Property. One hour. Professor VANCE.
Torts. Four hours.

Second Half-Year.

Contracts. Three hours. Professor VANCE.
Criminal Procedure. One hour. Professor EARNEST.
Commercial Paper. Four hours. Professor LORENZEN.
Constitutional Law. Two hours. Professor HARLAN.
Sales. Two hours. Professor BLAIR.
Property. One hour. Professor VANCE.
Agency. Two hours.
Bailments. One hour. Professor PEELLE.

SECOND YEAR.

First Half-Year.

Partnership. One hour. Professor PEELLE.
Common Law Pleading and Practice. Three hours. Professor JOHNSON.
Private Corporations. Four hours. Professor LORENZEN.
Insurance. One hour. Professor MAURY.
Evidence. Two hours. Professor PETER.
Property. One hour. Professor VANCE.

Second Half-Year.

Evidence. Two hours. Professor PETER.
Property. Four hours. Professor VANCE.
Equity. Two hours. Professor JAMES BROWN SCOTT.
Equity Pleading and Practice. One hour. Professor CLEPHANE.
Suretyship. Two hours.
Damages. One hour.

THIRD YEAR.

First Half-Year.

Property. Two hours. Professor VANCE.

Equity. Two hours. Professor JAMES BROWN SCOTT.

Third-year Moot Courts. Sessions, six hours. Required attendance, two hours. Professors CLEPHANE, EARNEST, and PETER.

Four hours of Electives.

Second Half-Year.

Trusts and Trustees. Two hours.

Federal Procedure. One hour. Professor MAURY.

Organization and Management of Corporations. One hour. Professor CLEPHANE.

Moot Courts. Session, six hours. Required attendance, two hours. Professors CLEPHANE, EARNEST, and PETER.

Four hours of Electives.

Third Year Electives.

Third year students may select from the following elective courses such subjects as, together with the required courses stated above, will make up the required minimum of ten hours a week. Such students are permitted, however, to choose the necessary electives from the courses offered to the fourth year students.

Elections of courses to be taken must be made in all cases within ten days after the beginning of the semester in which such courses are given.

Bankruptcy and Insolvency. Two hours, one-half year. Professor BRANDENBURG.

Wills and Administration. One hour, one-half year. Professor PETER.

International Law. One hour, one year. Professor BREWER.

Conflict of Laws. Two hours, one-half year. Professor LORENZEN.

Public Corporations. Two hours, one-half year. Professor LORENZEN.

Admiralty Law and Procedure. One hour, one-half year. Mr. HUGHES.

B. LEADING TO THE DEGREE OF MASTER OF LAWS.

Students admitted to the fourth year as candidates for the degree of Master of Laws are required to elect courses covering a minimum of ten hours a week. These may be freely elected from the subjects given below, which are considered by the Faculty especially suited

to the needs of students who have already completed an undergraduate course in law. The student may, however, choose as electives any other subjects offered by the Faculty of Law and Jurisprudence which he has not taken and received credit for during his undergraduate .course. The practice work offered in the fourth year Moot Courts may be taken and will be counted as two hours of required work.

Fourth Year Subjects.

Railroad Law (including Interstate Commerce). Two hours, one year. Professor NEEDHAM.

International Law. Three hours, one year. Professor JAMES BROWN SCOTT.

Extraordinary Legal Remedies. One hour, one-half year. Professor CLEPHANE.

Spanish-American Law.* Two hours, one year. Professor LORENZEN.

Roman Law. Two hours, one year. Professor HAU.

Administrative Law. Two hours, one-half year. Professor G. W. SCOTT.

Comparative Constitutional Law. Two hours, one-half year. Professor NERINCX.

Origin and Growth of the Constitutional and Common Law of England. Two hours, one year. Professor TAYLOR.

Advanced Procedure. One hour, one-half year. Professor CLEPHANE.

Moot Court. Two hours, one year. Professors CLEPHANE, EARNEST, and PETER.

Waters and Water Rights (including Irrigation). One hour, one-half year.

Land Titles and Statutory Liens. One hour, one year.

Taxation. One hour, one year.

Substantive Patent Law. Five lectures. Judge DUELL.

Legal Authorities and Brief-making. Six lectures. Professor BRANDENBURG.

C. LEADING TO THE DEGREE OF MASTER OF PATENT LAW.

A special course in Patent Law and Patent Law Practice is given by Professor Church. The purpose of this course is to prepare those taking it for practice in all matters involving the law of patents. The course extends throughout one year, with two lectures or sessions of the Moot Court each week.

A special course of lectures on Substantive Patent Law is delivered by Judge Charles H. Duell.

*A reading knowledge of Spanish is required.

D. Leading to the Degree of Doctor of Jurisprudence.

The purpose of these courses is primarily to give to the student a more thorough and comprehensive knowledge of International Law, of the History of Law, and of Comparative Public and Private Law in order that he may attain a sounder and more philosophic understanding of the principles that underlie our own municipal law. The training and knowledge acquired in these courses will prove specially beneficial to those who desire to fit themselves for the foreign service, for the conduct of cases before international tribunals, and for the general practice in matters involving the laws of foreign countries.

Subject to the approval of the Faculty, the student may select his major and minor subjects from the following courses offered:

I. Roman Law:

Offered by Asst. Professor Hau.

1. Introduction to Roman Law.
2. History and Sources of Roman Law Before the Time of Justinian.
3. The Institutes of Gaius and the *Corpus Juris* of Justinian.
4. History of the Law during the Middle Ages.
5. Canon Law.
6. Seminary in Roman Law.

II. The Common Law of England:

Offered by Professor Taylor.

1. Origin and Growth of the Constitutional and Common Law of England.
2. Seminary in the same subject.

III. International Law:

Offered by Professor J. B. Scott.

1. International Law.
2. Seminary in International Law.

Offered by Professor G. W. Scott.

3. International Law of Claims.

IV. Constitutional Law:

Offered by Professor Harlan.

1. Constitutional Law.

Offered by Professor Nerincx.

2. Comparative Constitutional Law.

V. ADMINISTRATIVE LAW:

Offered by Professor G. W. SCOTT.

1. Administrative Law.
2. Comparative Administrative Law.

VI. COMPARATIVE PRIVATE LAW:

Offered by Professor LORENZEN.

1. Comparative Commercial Law. (Not given in 1906-07.)
2. Spanish-American Law.*

ELECTIVE COURSES IN OTHER DEPARTMENTS OF THE UNIVERSITY.

Students taking a full course for a degree may be admitted, without additional fee except laboratory fees, to courses for which they are qualified in the Departments of Arts and Sciences and of Politics and Diplomacy, provided such courses do not exceed in the aggregate six hours a week.

COURSES IN PRACTICE.

A. MOOT COURT WORK.

1. *Third Year:*

Particular stress is laid upon Moot Court work. Aside from the practice court connected with the course in Patent Law, there are four courts in which the candidates for the degree of Bachelor of Laws pursue their work. Three of these are *nisi prius* courts and are presided over by members of the Washington Bar in active practice. The fourth is a Court of Appeals to review the cases tried in the courts of first instance. This court also is composed of members of the Washintgon Bar.

Every third-year student before receiving the degree of Bachelor of Laws is required to prepare the pleadings in and prosecute to judgment at least four cases in the *nisi prius* courts, with the privilege of appeal to the appellate tribunal. At least two hours in each week during the year must be spent by each third-year student in active participation in Moot Court work in the court-room to which he is assigned.

Statements of facts are furnished, such as would be related to a lawyer in active practice by his client. Each student must deter-

*A reading knowledge of Spanish is required.

mine whether or not upon such facts the particular case in hand is one of common-law or equitable cognizance. He must then frame his pleadings, serve his writs, and answer his adversary's pleadings until issue is joined in legal manner, after which the case is brought on for hearing in strict accordance with the rules of actual practice. Juries are empaneled in accordance with settled legal procedure, witnesses are examined and cross-examined, and the case conducted through all the various stages of the trial or hearing down to and including the judgment or decree, after which, should the case be appealed, it must be carried through the appellate court, involving the preparation of the record on appeal, briefs of counsel, etc.

2. *Fourth Year:*

The same facilities for Moot Court work as are described above are afforded in the course leading to the degree of Master of Laws. The court, however, is entirely distinct from that provided in the third-year course, and the nature of the cases assigned is somewhat different, involving, in addition to the ordinary cases at common law or in equity, cases of a special character, such as habeas corpus, certiorari, quo warranto, injunction, mandamus, extradition, replevin, attachment, etc.

3. *Officers and Equipment:*

One of the assistant clerks of the Supreme Court of the District of Columbia is the clerk of the court, but his assistants in each court-room are chosen from the student body, from whose ranks are also drawn the criers, jurors, and other officials, thus giving to the students the benefit of practice in administrative judicial machinery. The Moot Court is to all intents and purposes an actual court. The rooms in which the sessions are held are fitted up with judges' benches, clerks' desks, jury-boxes, and counsel table, and from the time the crier announces that the court is in session until he announces its adjournment the procedure is identical with that of a regular judicial tribunal.

It is believed that any student who gives the proper attention to this feature of the law curriculum will be enabled to go out from this institution and creditably try cases in court, although he may never have been in an actual court-room.

A careful record is kept of the work of each student, both as to his pleadings and his conduct of the case in court, and the ratings thus given determine, in connection with his ratings upon other subjects, whether or not he is entitled to a degree.

B. Advanced Procedure.

Every young lawyer entering upon his professional career is desirous of availing himself of the experience of an older practitioner and of learning many things which are not taught and cannot be taught from books. It is to meet the needs of this class of men that this course has been inaugurated. It is in charge of a member of the Washington Bar whose practice has been an active one, extending over a period of sixteen years.

A short introductory talk is given upon the relations between attorney and client, including the important subject of fees, after which the student is given the benefit of practical hints upon the manner of starting in practice and opening and furnishing an office, suggestions as to office systems and the selection of a library, and, incidentally, of the use of authorities in court. Then a drill is given upon contract drafting, involving the preparation by the student of leases, contracts, wills, etc. The students' papers are carefully examined by the instructor and criticised, prevalent errors and the proper manner of curing them being pointed out in the class-room.

The student is told how to listen intelligently to his client's grievances; how to draw up the pleadings arising out of these grievances; how to prepare for trial the case thus made, including the work of preparing the evidence; how to try the case and examine and cross-examine witnesses; the manner of making up the record, writing briefs, and conducting the argument on appeal. The subject of professional ethics is discussed. The course is concluded by a series of talks from a practical standpoint upon affidavits of merit and defense, attachments, replevin, habeas corpus, mandamus, etc. At various times during the year distinguished lawyers are invited to appear and discuss informally special topics of interest to the students.

EXAMINATIONS.

A. Undergraduate Courses.

Regular Examinations:

Written examinations upon all required subjects are held at the close of each semester upon those subjects that have been completed during that semester. All students, unless specially excused by the Dean, are required to take the first examination held in any subject after their completion of the course in that subject.

No student, except by special permission of the Dean, will be allowed to take an examination in any subject unless he shall be regularly registered and have been in regular attendance upon the lec-

tures and have done all the work required in the course of instruction upon that subject.

Conditions:

The regular examinations for the removal of conditions will be held during the first week of each session. Candidates for the degree of Bachelor of Laws who have not more than one condition in the subjects completed during the first semester of the third year may be given examinations for the removal of such conditions during the last week in May.

Class Standing:

Students having conditions in more than two subjects will not be advanced from one class to another. Students may have, however, an opportunity to remove conditions imposed during any academic year by taking the regular examinations for the removal of conditions at the beginning of the following year, for which no fee is charged.

Students having conditions in more than three subjects will not be allowed to register except upon special permission from the Dean.

Special Examinations:

No special examinations, other than those above provided for, will be granted to any students except those of the graduating class who, for good cause, shall have been excused by the Dean from taking any regular examination during the third year.

B. Graduate Courses.

Examinations in graduate courses will be given at such times and under such conditions as may be designated by the professors in charge.

DEGREES.

1. Bachelor of Laws.

The degree of Bachelor of Laws will be conferred upon students who shall have passed satisfactory examinations upon the subjects required in the entire course of three years and whose attendance and conduct have been satisfactory to the Faculty.

2. Master of Laws.

The degree of Master of Laws will be conferred upon students who have successfully completed the work prescribed for the fourth year and whose attendance and conduct have been satisfactory to the Faculty.

3. MASTER OF PATENT LAW.

The degree of Master of Patent Law will be conferred upon students who shall have successfully completed the work of the Patent Law course and whose attendance and conduct have been satisfactory to the Faculty.

4. DOCTOR OF JURISPRUDENCE.

The degree of Doctor of Jurisprudence is given for graduate work in the science of the law upon the same terms and conditions as the degree of Doctor of Philosophy in the Departments of Arts and Sciences and of Politics and Diplomacy.

The degree is conferred upon students already qualified as candidates for the degree who have pursued advanced legal studies and engaged in original research in some special branch of law under University auspices for a period of not less than three years, two of which shall be in residence, and have submitted an acceptable thesis and met all the requirements prescribed. The degree is given, however, not because of the faithful completion of a course of study according to a stated program for a given length of time, but for high attainments and proved ability to do research work in some special branch of law, as determined by the various tests applied.

The applicant may be credited with graduate work done at other universities, provided that such work is shown to be of grade and nature similar to that required here, but at least one year must be spent in residence at this University, and the other requirements of the degree as prescribed here must be fulfilled.

Every candidate immediately after qualifying for the degree of Doctor of Jurisprudence shall designate one principal or major subject and two subordinate or minor subjects, the selection to be approved by the Faculty. The major subject and at least one of the two minors must be topics taught in the Department of Law and Jurisprudence; the other minor may be chosen from any graduate work in the University properly relative to his major and approved by the Faculty. The major and minors must be pursued under the guidance of a committee consisting of the professors in charge of the subjects chosen, with the professor in the major subject as chairman. This committee shall determine his division of time, study, and research among the major and minor topics, but in general at least one-half of the whole time spent in graduate work should be devoted to the major subject and one-fourth of the time to each of the minor subjects.

The candidate must attend the seminary work in his major subject and take the graduate courses given in his major and minors.

The candidate shall pass satisfactory examinations upon the three subjects selected, which may be taken on the fulfilment of the require-

ments as to residence or at such other times as may be fixed by the committee in charge of such candidate. In his major subject the candidate must show special attainments, and is liable to minute examination upon the whole ground which it covers. He is also expected to have a good general knowledge of the field contained within his two minor subjects.

A satisfactory thesis must be presented by the candidate, together with an exhaustive bibliography, exhibiting independent research in some branch of his major subject, not later than January 15 or May 1 in the year in which the degree is sought, according as he proposes to be graduated at the Winter Convocation or at Commencement.

After their acceptance theses are the property of the University, and must be deposited in the University archives, but authors are permitted to make copies. All theses must be typewritten on official thesis paper, which may be obtained from the Assistant Treasurer of the University.

No thesis for the degree of Doctor of Jurisprudence shall be submitted to the Faculty until it has been approved by the professor in supervision of the major topic, and also by a co-referee to be appointed by the Faculty. The referees shall present to the Faculty written reports on the thesis, to be filed therewith.

The candidate is expected to print his thesis, under the supervision of the professor in charge of his major topic, within one year after the degree is conferred, and shall present one hundred copies to the University, to be distributed among institutions of learning.

The candidate must defend his thesis in the presence of the Faculty or of so many of its members as may be designated by the Faculty.

LAW LIBRARY AND READING-ROOM.

A well-equipped working library, comprising more than 4,000 volumes, is open to the students in Law Lecture Hall from 9 a. m. to 10 p. m. Competent librarians are in charge and will give students assistance in looking up subjects and in the use of books.

The Library contains the standard text-books, the West Reporter system of Federal and State decisions complete, State Reports, the English Common Law and Chancery Reports, Encyclopædias of Law, Digests, reference books, and current law publications.

Adjoining the Library is a conversation-room for students affording opportunity for consultation.

In addition to these facilities, the students have free access to the Congressional Library and other public libraries.

SCHOLARSHIPS AND FELLOWSHIPS.

Two scholarships of an annual value of three hundred dollars each have been established in the Department of Law and Jurisprudence, to be awarded to applicants who desire to become candidates for the degree of Doctor of Jurisprudence. It is hoped that other scholarships and fellowships may soon be announced. Appointments to these scholarships will be made in accordance with the following regulations adopted by the Faculty:

(1) All appointments to scholarships shall be made by the Faculty upon nomination by the Committee on Prizes and Scholarships not later than June first of each year. Such appointments shall be for one year, subject to renewal at the discretion of the Faculty.

(2) All applicants for such scholarships shall be required to submit to the Registrar of the University, not later than May first of each year, statements of their qualifications, accompanied by such papers and certificates as may be necessary to support the statements made.

(3) Any person appointed to a scholarship must be at least twenty-one years of age, must have been graduated both in Arts or Sciences and in Law from institutions of recognized standing, and must possess, in addition to English, such a knowledge of Latin, French, and one other modern language as will enable him to read readily works written in those languages.

(4) Any appointee to a scholarship must be resident in the University during the whole session for which the scholarship is awarded and must give his whole time and attention during such session to the work for which he has registered.

PRIZES.

A prize of $100, called "The Parker Prize," in honor of its donor, Hon. Myron M. Parker, is awarded each year to the student who attains the highest general average in examinations during the full three-years' course for the degree of Bachelor of Laws.

A prize offered by the Edward Thompson Company, of a set of the Encyclopædia of Law, first or second edition, or a set of the Encyclopædia of Pleading and Practice, is awarded each year to the senior law student who shall write the best thesis on some legal subject to be assigned by the Faculty.

Three prizes—one of $40, one of $30, and one of $20—are annually given to the respective authors of the best three essays handed in by such members of the Third-Year Class as shall compete for them and shall pass successful examinations.

A prize of $25 in gold, given by John Thilman Hendrick, and called the "David S. Hendrick Memorial Prize in Insurance Law," in honor of Mr. David S. Hendrick, will be awarded each year to the student in the Second-Year Class who writes the best essay upon some question in Insurance Law which will be selected and approved by the Faculty.

A prize of $25 in gold, offered by Mr. Fritz von Briesen, called the "Ellsworth Prize," is awarded for the best work done in the Patent Law Course by a student receiving the degree of Master of Patent Laws.

PUBLIC SPEAKING.

Excellent facilities for training in the art of public speaking are afforded by the two debating societies that have been organized in the Department of Law and Jurisprudence. These societies, known as the Columbian and Needham Debating Societies, meet weekly for debate in Law Lecture Hall. Membership in these societies is entirely optional, but their work is encouraged in every legitimate way by the Faculty, and students are urgently advised to take part in their exercises. During each academic year several intercollegiate debates are held. Membership upon the intercollegiate debating teams is an honor eagerly sought and made the prize to be won in separate preliminary contests. The general conduct of these intercollegiate debates is under the supervision of a committee from the Faculty.

Further opportunity for training in parliamentary procedure and debate is given by the University Congress, an organization patterned after that of the Congress of the United States, in which bills are introduced and debated and the general procedure of legislative assemblies followed.

ADMISSION TO THE BAR OF THE DISTRICT OF COLUMBIA.

By the rules of the Supreme Court of the District of Columbia, applicants for admission to the Bar are required to have studied law for three years under the direction of a competent attorney, but by those rules the course in the Department of Law of the University is regarded as discharging this requirement.

FEES.

1. Matriculation fee (payable only on first entry into the University)	$5
2. Library fee per annum	2
3. Tuition fee per annum	150
4. Fee for graduation	10
5. Tuition fee for course in Patent Law	40
6. Tuition fee per annum for any year repeated once	75
7. Fee for a certificate under the seal of the University	2

8. Auditors are admitted to lecture courses for the regular tuition fees, but are not permitted to take active part in the work of the classes, and will not be allowed credit, in a subsequent course of studies leading to a degree, for attendance as auditors. No matriculation or library fee is charged.

No change will be made in the fees fixed at the time of registration except in case of withdrawal, and then only upon notice in due form, and from the end of the current quarter session when such withdrawal shall be approved. Applications for the granting of a withdrawal should be made on the prescribed form to be obtained from the Registrar and will only be received at the end of a quarter session.

The library fee will not be charged for the first half-year during which a course is completed in the case of students who enter at the beginning of the second half-year and pay the library fee for that year.

PAYMENT OF FEES.

All fees are to be paid to the Assistant Treasurer. Regular tuition fees are payable quarterly in advance. Fees for special courses are payable monthly in advance. Matriculation and library fees are payable in full in advance.

BOARD AND ROOMS.

The price of table board and rooms varies according to locality. Good accommodations may be secured at some distance from the University buildings for two hundred dollars for the session of thirty-three weeks. In the neighborhood adjacent to the University, by reason of its nearness to the heart of the best business sec-

tion of the city, prices range from two hundred and fifty to three hundred and fifty dollars for the session of thirty-three weeks. Students frequently form clubs for the purpose of obtaining a reduction in the cost of living. A register of approved boarding-houses is kept by the Assistant Treasurer, who will gladly furnish information in relation thereto or in connection with any other matters looking to the comfort of students seeking a residence in the city of Washington.

For catalogues, application blanks and further information address

THE REGISTRAR,
The George Washington University,
Washington, D. C.

DEPARTMENT OF POLITICS AND DIPLOMACY.

FACULTY.

CHARLES WILLIS NEEDHAM, LL.D. . . . . . PRESIDENT OF THE UNIVERSITY
†——— . . . . Dean and Professor of Political Science
JOHN M. HARLAN, LL.D. . . Professor of American Constitutional Law
DAVID J. BREWER, LL.D. . . . . Professor of International Law
JOHN W. FOSTER, LL.D. . . . . Professor of American Diplomacy
*DAVID J. HILL, LL.D. . . . . Professor of European Diplomacy
CHARLES C. SWISHER, Ph.D., LL.D. . . Professor of History and Politics
HANNIS TAYLOR, LL.D. . . . . . . Professor of the History of English Law
OSCAR P. AUSTIN . . . . Professor of Commercial Geography
GEORGE WINFIELD SCOTT, Ph.D., LL.B. Professor of Administrative Law
ERNEST G. LORENZEN, Ph.B., LL.B., J.U.D. . . . . Professor of Comparative Commercial Law
C. WILLIAM A. VEDITZ, Ph.D., LL.B. . . . . Professor of Economics
HENRY PARKER WILLIS, Ph.D. . . . . Professor of Finance
WILLISTON S. HOUGH, Ph.M. . . . . Professor of Political Theory
ALFRED NERINCX, LL.D. . . Professor of Comparative Constitutional Law
JAMES BROWN SCOTT, A.M., J.U.D. . . . . Professor of International Law and Diplomacy
JOHN W. HOLCOMBE, M.Dip. . . . . Assistant Professor of Politics
CHARLES RAY DEAN, M.Dip. . . . . Assistant Professor of European Diplomacy

LECTURERS.

HERMANN SCHOENFELD, Ph.D., LL.D. . . . Lecturer on European Politics
CARROLL D. WRIGHT, LL.D. . . . . Lecturer on Statistics and Social Economics
MITCHELL CARROLL, Ph.D. . . . . Lecturer on Roman Political Institutions
JAMES C. MONAGHAN, A.M. . . . . Lecturer on the Consular Service
†——— . . . . Lecturer on European Diplomacy

OTIS D. SWETT, B.S., LL.M. . . . . Secretary

*Absent on leave. †To be appointed.

GENERAL STATEMENT.

The "Department of Jurisprudence and Diplomacy" of the University was established in June, 1898, and was formally opened in November of the same year. For a number of years it was closely affiliated with the Law Department. In the fall of 1905, however, this Department ceased to have any organic connection with the Law Department. It now constitutes a distinct branch of the professional and graduate work of the institution, designated as the Department of Politics and Diplomacy. This name is intended to indicate that the purpose of the Department is to fit men for the public service, particularly for the consular and diplomatic service, and to supply that knowledge of the public life of this country and of foreign countries that will be of most value to journalists, teachers, and other persons aiming to become moulders of public opinion upon the national and international issues of the day.

The work of the Department is divided into four groups of courses, as follows: (1) Public Law; (2) Political Science; (3) Economics and Sociology; (4) History.

ADMISSION.

The Department of Politics and Diplomacy is both a graduate and professional school. Before a student can be admitted he must give evidence that he has completed a liberal undergraduate course of academic study such as is required by colleges of good standing antecedent to the baccalaureate degree. The President's Council reserves the right to decide in all cases whether the antecedent training fulfils the requirements. No student, however, can be admitted to regular standing unless he has a fair knowledge of at least one modern European language—French, German, Spanish, or Italian.

Any person approved by the Faculty may attend one or more courses as a special student, and will receive for the satisfactory completion of such course or courses a certificate of proficiency. All the departments of the University are open to regular students in this department without additional charge. No student, however, will be permitted to carry on simultaneously work for two distinct degrees unless this is expressly allowed. Upon the presentation of satisfactory evidence, students coming here from other institutions to complete their studies may be admitted to advanced standing if thev have already done work equivalent to that required here.

DEGREES.

Two degrees are conferred for the satisfactory completion of work required in this Department—that of Master of Diplomacy and that of Doctor of Philosophy.

Candidates for the degree of Master of Diplomacy must pass at least two full years of residence at this University. They shall sustain satisfactory examinations on the studies pursued, and present an acceptable thesis, together with a bibliography of the subject investigated. Each student, moreover, must have satisfactorily completed, before he can graduate, courses aggregating at least ten hours per week for each of the two years of his residence. This total number must include all of the courses that are hereinafter designated as "required." In the selection of elective courses to make up the total number of hours required, students must consult with the Advisory Committee of the Faculty of this Department. No course taken by a student shall be counted twice in the fulfilment of requirements for degrees. No student can graduate who has not passed a satisfactory examination, at the end of his course, in two modern European languages, one of which must be French. Theses for the Master's degree in Diplomacy must be presented in their final form not later than six weeks before the date of the convocation at which the candidate expects to receive the degree. There are two convocations annually—one in February and one in June.

Candidates for the degree of Doctor of Philosophy in this Department must have pursued specialized courses in University subjects and engaged in original research in certain of the subjects taught in this Department, under the auspices of the professors in charge of those subjects, for a period of not less than three years, and have submitted an acceptable thesis and met all the requirements prescribed. The degree is given, however, not because of the faithful completion of a course of study according to a stated programme for a given length of time, but for high attainments and proved ability to do research work in some special branch of knowledge, as determined by the various tests applied.

Before a student can become a candidate for the degree of Doctor of Philosophy in this Department he must give evidence that he has completed a liberal undergraduate course of academic study such as is required by colleges of good standing antecedent to the baccalaureate degree. The President's Council reserves the right to decide in all cases whether the antecedent training fulfils the requirements. Should the candidate for the degree of Doctor of Philosophy already possess the degree of Master of Diplomacy and elect his major subject and at least one minor from among the subjects offered in the Department of Politics and Diplomacy, the minimum period of further study requisite for at-

taining the degree shall be two years instead of three. The applicant for the Doctor's degree may be credited with graduate work done at other universities, provided that such work is shown to be of a grade similar to that required here; but at least one year must be spent in residence at this University, and the other requirements of the degree as prescribed here must be fulfilled.

Candidates for the degree of Doctor of Philosophy shall offer themselves in three topics from the University subjects—one major and two collateral minor studies—the combination to be approved by the President's Council. These must be pursued under the guidance of a committee consisting of the professors in charge of the major and minor topics, with the professor in the major subject as chairman. This committee, in charge of the candidate, shall determine his division of time, study, and research in the major and minor topics, but in general the major topic should be pursued during the whole time devoted to graduate work and each minor topic during at least one year.

The candidate shall pass satisfactory written examinations upon the three subjects selected. The examinations in the minor topics may be taken at the completion of the courses pursued or at the discretion of the professors in charge. In written examinations the time limit is four hours for the major and three hours for the minor topics.

The candidate must show that he possesses a knowledge of French and German, as evidenced by familiarity with the French and German literature pertaining to his special branches of study. The head professor of a subject may require such knowledge of other subjects as is considered fundamental.

The candidate must present a satisfactory thesis, together with an exhaustive bibliography, not later than six weeks before the date of the convocation at which he expects to receive the degree. The thesis must represent independent thinking and research in some branch of his major subject.

After their acceptance theses shall become the property of the University and must be deposited in the University archives, but authors are permitted to make copies. All theses, before submission for the degree, must be typewritten on official thesis paper, which may be obtained from the Assistant Treasurer of the University.

No thesis for the degree of Doctor of Philosophy shall be submitted to the University Council until it has been approved by the professor having supervision of the major topic, and also by a co-referee to be appointed by the President's Council. The referees shall present to the Council written reports on the thesis, to be filed therewith.

The candidate is expected to print his thesis, under the supervision of the professor in charge of his major topic, within one year

after the degree is conferred, and shall present one hundred copies to the University, to be distributed among institutions of learning. The candidate, finally, must defend his thesis and submit to an oral examination upon his major topic before a board of experts, to be appointed by the President's Council, consisting of three specialists of university standing and established reputation in the subject represented by the principal topic.

SCHEDULE OF COURSES.*

REQUIRED COURSES.

First Year, First Half-year:

International Law. One hour. Professor BREWER.
European Diplomacy. One hour. Professor J. B. SCOTT.
History and Methods of Arbitration. One hour. Professor ———.
Statistics. Two hours. Professor WILLIS
Economic and Commercial Geography. Two hours. Professor AUSTIN.
Modern European History. Two hours. Professor SWISHER.

First Year, Second Half-year:

International Law. One hour. Professor BREWER.
European Diplomacy. One hour. Professor J. B. SCOTT.
Organization of the State Department. One hour. Professor ———.
Statistics. Two hours. Professor WILLIS.
Economic and Commercial Geography. Two hours. Professor AUSTIN.
Modern European History. Two hours. Professor SWISHER.

Second Year, First Half-year:

History of American Diplomacy and Treaties. One hour. Professor FOSTER.
International Law. Three hours. Professor J. B. SCOTT.
Comparative Constitutional Law. One hour. Professor NERINCX.
Political History of the United States. Two hours. Professor SWISHER.
International Trade. Two hours. Professor VEDITZ.
Seminary in Political Science. Professor ———.

*Subject to changes which will be announced in the special bulletin of this Department.

Second Year, Second Half-year:

International Law. Three hours. Professor J. B. Scott.
Comparative Constitutional Law. One hour. Professor Nerincx.
Political History of the United States. Two hours. Professor Swisher.
The Consular Service. One hour. Mr. Monaghan.
Seminary in Political Science. Professor ——.

The Seminary in Political Science will meet once each week for a session of at least two hours' duration. The seminaries for graduate students in Arts and Sciences are open to students in the Department of Politics and Diplomacy provided they possess the requisite antecedent training.

Students in the Department of Arts and Sciences who desire to take the course in Politics and Diplomacy are allowed to count the completed work of the first year in the Department of Politics and Diplomacy, which involves research and extensive reading in addition to the class-room work, as fifteen points in fulfilment of the requirements prescribed for an academic degree. Thus it is possible for a student to combine his last year in college with his first year in the Department of Politics and Diplomacy, and to receive a baccalaureate degree in arts or science, and the master's degree in diplomacy, one year sooner than would otherwise be possible.

Students in this Department are required to take *at least* ten hours' class-room work per week in each year of the course, and in order to fulfil this requirement they may select from among the following elective courses, most of which are also offered for advanced students in the Department of Arts and Sciences:

ELECTIVE COURSES.

(Open to both first and second-year students.)

First Half-year only:

Bismarck as a Statesman. One hour. Professor Schoenfeld. (In alternate years; not given in 1906-07.)
Disraeli as a Statesman. One hour. Professor Swisher. (In alternate years; given in 1906-07.)
Colonial Politics. One hour. Professor Swisher.
The Theory of the State. Two hours. Professor Hough.
Industrial Evolution. Two hours. Professor Veditz.
The Science of Society. Two hours. Professor Veditz.
Statistics and Social Economics. Professor Wright.

Second Half-year only:

Railway Law, including Interstate Commerce. Two hours. President NEEDHAM.

Problems of Eastern Europe. One hour. Professor SCHOENFELD. (In alternate years; given in 1906-07.)

The Oriental Problem. One hour. Professor SWISHER. (In alternate years; not given in 1906-07.)

American Social Problems. Two hours. Professor VEDITZ.

Theory of Rights. Two hours. Professor HOUGH.

Public Life of the Romans. Two hours. Professor CARROLL.

Socialism and Social Reform. Two hours. Professor VEDITZ. (In alternate years; not given in 1906-07.)

Labor Legislation. Two hours. Professor VEDITZ. (In alternate years; given in 1906-07.)

Through the Year:

British Imperialism. Two hours. Professor SWISHER.

Comparative Politics. Two hours. Professor ———.

Comparative Commercial Law. Two hours. Professor LORENZEN. (In alternate years; not given in 1906-07.)

Origin and Growth of the Constitution and Common Law of England. Two hours. Professor TAYLOR.

Constitutional Law of the United States. One hour. Professor HARLAN.

Money and Banking. Two hours. Professor WILLIS.

The History of Political Theories. One hour. Professor HOUGH.

Public Finance. Two hours. Professor WILLIS. (In alternate years; not given in 1906-07.)

Corporation Finance. Two hours. Professor WILLIS. (In alternate years; not given in 1906-07.)

Accounting. Two hours. Professor WILLIS. (In alternate years; given in 1906-07.)

Political Economy. Three hours. Professor VEDITZ.

Detailed statements of the scope of these courses and the methods of instruction employed in the Department will be published soon after this catalogue is issued, and can be obtained upon application to the Registrar of the University.

In view of the fact that students in this Department are required, before graduating, to be familiar with two modern European languages, of which one shall be French, the courses in French, German, Spanish,

and Italian which are offered in Columbian College will be open to students in Politics and Diplomacy.

Arrangements are being made to provide for a number of lecture courses not enumerated in this Catalogue. These will probably include special lectures on the organization of the diplomatic service of other nations, the history of international conventions, and on the lives of eminent statesmen and diplomats, by some of the Diplomatic Corps resident in Washington and by other distinguished public men.

SCHOLARSHIPS.

All appointments to scholarships shall be made by the Faculty upon nomination by a committee, appointed for this purpose, not later than June first of each year. Such appointments shall be for one year, subject to renewal at the discretion of the Faculty. Applicants for such scholarships must submit to the Registrar of the University, not later than May first of each year, statements of their qualifications accompanied by such papers and certificates as may be necessary to support the statements made. Any person appointed to a scholarship must be at least twenty-one years of age, have been graduated in Arts or Sciences from an institution of recognized standing, and must possess, in addition to English, such a knowledge of French and one other modern language as shall enable him to read readily works written in those languages. Any appointee to a scholarship must be resident in Washington during the whole session for which the scholarship is awarded, and must give his undivided time and attention during such session to the work for which he is registered.

The Draper Scholarship.

General William F. Draper, of Massachusetts, former ambassador to Italy, has established in The George Washington University in the Department of Politics and Diplomacy a scholarship carrying $300 annually to the recipient. General Draper in his long experience in Congress as a member of the Foreign Affairs Committee as well as from his experience abroad is greatly impressed with the importance of training men for the diplomatic service, and he has the deepest interest in the enlarged and reorganized work in The George Washington University in the Department of Politics and Diplomacy. The scholarship will be offered primarily to students from Massachusetts and Virginia and will be awarded by the Dean of the Department upon such terms and conditions as shall be prescribed. General Draper's action will naturally

appeal to others who are interested on the same lines and it is confidently believed that from different parts of the country will come additional evidences of the aroused public sentiment for the better training of men for the consular and diplomatic service as well as for those who may seek this branch of study for professional work as counsellors before international and arbitration commissions or for professorial careers.

FEES.

1. Matriculation fee (payable only on first entry into the University)	$5.00
2. Library fee per annum	2.00
3. Tuition fee per annum	150.00
4. Fee for graduation	10.00
5. Tuition fee per annum for any year repeated once, or for each year in addition to the years of required work	75.00
6. Fee for a certificate under the seal of the University	2.00

7. Auditors are admitted to lecture courses for the regular tuition fees, but are not permitted to take active part in the work of the classes, and will not be allowed credit, in a subsequent course of studies leading to a degree, for attendance as Auditors. No matriculation or library fee is charged.

No change will be made in the fees fixed at the time of registration except in case of withdrawal, and then only upon notice in due form and from the end of the current quarter session when such change or withdrawal shall be approved.

Payment of Fees.

All fees are to be paid to the Assistant Treasurer. Regular fees are payable quarterly, in advance. Matriculation, library, and fees for special courses are payable in full, in advance.

BOARD AND ROOMS.

The price of table board and rooms varies according to locality. Good accommodations may be secured at some distance from the University buildings for two hundred dollars for the session of thirty-three weeks. In the neighborhood adjacent to the University, by reason of its nearness to the heart of the best business section of the city, prices range from two hundred and fifty to three

hundred and fifty dollars for the session of thirty-three weeks. Students frequently form clubs for the purpose of obtaining a reduction in the cost of living. A register of approved boarding-houses is kept by the Assistant Treasurer, who will gladly furnish information in relation thereto or in connection with any other matters looking to the comfort of students seeking a residence in the city of Washington.

For catalogues, application blanks, and further information address

THE REGISTRAR,
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NATIONAL COLLEGE OF PHARMACY.

FACULTY.

Charles Willis Needham, LL.D. . . . . President of the University
Henry E. Kalusowski, M.D., Phar.D. . . . . Dean and Professor of Pharmacy
Samuel Waggaman, M.D., Phar.D. . . . . . . Professor of Materia Medica, Botany and Toxicology
William F. Hillebrand, Ph.D., Phar.D. . . . . . Professor of Chemistry and Physics.
Frederick A. Holton, B.S., Phar.D. . . Professor of Analytical Chemistry
Burton J. Howard, B.S. . . . . Professor of Microscopy
Howard M. Bradbury, Phar.D. . . . . Assistant to the Professor of Analytical Chemistry
Harry A. Candee, Phar.D. . . . . . Assistant to the Professor of Pharmacy
Cyrus W. Nelson, B.S. . . . . Assistant to the Professor of Pharmacy
Fred H. Pitzer. . . . . Assistant to the Professor of Pharmacy
*——— . . . . Professor of Mercantile Pharmacy
*——— . . . . Professor of Pharmaceutical Jurisprudence

BOARD OF EXAMINERS.

Henry E. Kalusowski, *Chairman.*

Lewis Flemer.
Frank C. Henry.
Samuel L. Hilton.
Burton J. Howard.
Samuel Waggaman.
Frederick A. Holton.
Giles G. C. Simms.
William F. Hillebrand.

GENERAL STATEMENT.

The National College of Pharmacy, which is an outgrowth of the Columbian Pharmaceutical Association, organized in April, 1871, was chartered under the provisions of an act of Congress in 1872, and opened its doors to students November 11th of that year. From the date of its organization, the college steadily advanced in material prosperity, until in 1888 it erected a large and commodious building of its own, where the exercises are now held. In February, 1906, it became a member of the educational system of The George Washington University, under the charter of the University granted by Congress March 3, 1905, providing for the organization of colleges. The President of the University is

*To be appointed.

ex officio president of the National College of Pharmacy, and the College is represented in the President's Council by its Dean.

The work of the college embraces courses in chemistry and toxicology, materia medica, botany, pharmacy, analytical chemistry, and pharmaceutical laboratory work and microscopy. Courses have recently been added in mercantile pharmacy and pharmaceutical jurisprudence. Three years are required for the completion of the prescribed course.

The new College building is centrally located on I street, northwest, between Eighth and Ninth streets. It is easily reached by either of the four principal street car lines of the city.

The College requires for entrance a knowledge of the branches usually taught in the public schools of Washington, D. C., sufficient to entitle the applicant to admission to the High School. Evidence of this may be shown by certificate or by the results of an examination to be held at the College, September 20, 1906. Certificate of proficiency should be in the hands of the Secretary of the College on or before September 20, 1906.

SPECIAL COURSES.

Students who so desire it may select one or more of the branches taught, and upon payment of the fee for single tickets, attend the lectures and laboratory work during the time set apart for such study.

Students taking single tickets will not be entitled to take the examinations for the degree conferred by the College.

THE DEGREE.

The Degree conferred is *Doctor of Pharmacy*.

QUALIFICATIONS FOR THE DEGREE.

1. The candidate must be *twenty-one years of age*.
2. He shall have had four years practical instruction in a pharmacy under the direction of a competent preceptor.
3. He shall have attended three courses of instruction in Chemistry, Pharmacy, Analytical Chemistry, Materia Medica, Botany, and Toxicology, and two in Microscopy, the last of which must have been in this College; and one course each in Mercantile Pharmacy and Pharmaceutical Jurisprudence.
4. He must have passed a satisfactory examination in each of the branches taught.
5. He must be recommended by the Board of Examiners.

MATERIA MEDICA, BOTANY AND TOXICOLOGY.

Freshman Course.

The first four or five lectures constitute an introduction to the study of elementary botany, after which follow in order vegetable histology and plant physiology. The subject-matter of these lectures is thoroughly explained by means of charts, diagrams and specimens.

Junior Course.

The lectures in this course are devoted to the consideration of the various theories concerning the vegetable world and the practical results obtained by experienced laborers in this vast field of science. During the time devoted to these subjects the lecturer illustrates the lectures by means of the lantern and microscope. A large part of the course is devoted to a consideration of the official organic drugs.

Senior Course.

The lectures following the junior course on plants and their relation to Materia Medica are mainly upon the active principles, adulterants, official preparations, therapeutic uses, and doses; after which the organic and inorganic poisons are taken up under three heads: 1st, Corrosive; 2d, Irritant; and 3d, Neurotic Poisons. Under these three divisions are explained briefly their action, detection and antidote.

PHARMACY.

Freshman Course.

This course is given to the study of the various pharmaceutical processes and operations. The opening lecture defines Pharmacy and states its relations to the arts and sciences; then follow in the order named lectures on metrology, heat, thermometry, evaporation, distillation, fusion, sublimation, calcination, granulation, comminution, solution, filtration, clarification, decoloration, precipitation, crystallization and extraction, during which the various methods used to bring about the desired results will be illustrated.

Junior Course.

During the first part of this course the time is given to the application of the processes considered during the Freshman year to pharmacopœial preparations, and such modifications thereof as

adapt them to special uses. This will include methods for making solutions of various substances, extracts, pills, tablets, triturates, compressed tablets, capsules, powders (simple and compound), suppositories, plasters, ointments, cerates, and oleates.

The latter part of this course is taken up with the study of official preparations obtained from the mineral kingdom, beginning with bromine, chlorine, iodine, phosphorus, and sulphur, followed in the order named by carbon, boron, silicon, the inorganic acids, potassium, sodium, lithium, ammonium, magnesium, calcium, barium, zinc, aluminum, cerium, cadmium, manganese, iron, chromium, lead, silver, copper, mercury, antimony, arsenic, bismuth and gold.

SENIOR COURSE.

The time during this course is mainly given to the study of compounds chiefly derived from organic matter, such as cellulose and products obtained therefrom, amylaceous, mucilaginous and saccharine substances; glucosides and alkaloids, volatile oils and animal products commonly used in pharmacy, vegetable oils, soaps, resinoids and products from resins.

ANALYTICAL CHEMISTRY.

The instruction in this department is intended to present to the student the chemical tests of the United States Pharmacopœia; to familiarize him with methods for the identification of substances and for the detection of impurities; to instruct him in the methods of assaying and the use of volumetric solutions, and to enable him to analyze any ordinary mixture of inorganic material.

The course of instruction embraces three years of practice in the chemical laboratory and class-room exercises.

For the purpose of carrying out the work of this department a large, well-equipped laboratory is provided having drawer and locker accommodations for one hundred and twenty students and desk space for forty students working together at one time. The laboratory is provided with the usual water and gas facilities, and has recently been wired and installed with electric apparatus whereby electro-chemical methods of analysis can be taught and the application of the electric current to the preparation of chemicals by the methods of electro-chemistry can be illustrated before the students. The laboratory is also provided with ample hood facilities for keeping the atmosphere of the room free as possible from deleterious fumes, and is equipped with means for giving an ample supply of distilled water. These and other facilities afford

students exceptional opportunities to become familiar with the fundamental principles of the science of chemistry.

The first year is devoted to experimental work so arranged as to supplement the lectures in General Chemistry. The student attains a knowledge of elementary principles, becomes familiar with manipulating apparatus, and is prepared to commence analytical work.

The second year covers a systematic course in qualitative analysis in connection with the tests of the United States Pharmacopœia.

The third year is devoted to volumetric analysis by means of the standard solutions of the Pharmacopœia.

GENERAL CHEMISTRY AND PHYSICS.

Inasmuch as the subjects of Analytical Chemistry and Pharmacy are fully provided for in other courses, these lectures are devoted more closely to the fundamental principles and classification which must underlie a thorough and systematic knowledge of Chemistry. Owing to the intimate connection existing between Chemistry and several branches of Physics, a number of lectures illustrating the more important laws and principles of some of these branches precedes the regular course in Chemistry, and others on these subjects with which a prior acquaintance is less important, follow after the student has acquired some knowledge of chemical changes. During the first half of the second year Physics and the non-metallic elements receive consideration, followed during the remainder of the second and a portion of the third year by the metals. The greater portion of the third year is devoted to the exposition of the more important facts, principles, and theories of Organic Chemistry.

Quizzes are held frequently throughout the three years, in order to test the students and to enliven their interest in the various subjects.

MICROSCOPY.

This College, recognizing the importance and value of Microscopy in the practice of Pharmacy, has established a separate course in this branch and requires full attendance from Junior and Senior students. The course of Microscopy gives instruction in the use of the compound microscope as an aid in the study and identification of drugs.

The work includes both lectures and laboratory courses, and consists in the examination of plant tissue as illustrated in various vegetable substances most familiar to pharmacists. Special attention is given to the structural characteristics by which one drug can be distinguished from another as well as to the detection and identification of the most common adulterants used.

MERCANTILE PHARMACY AND PHARMACEUTICAL JURISPRUDENCE.

These courses are required in the Senior class only. The names of the lectures and titles of text-books will be announced later.

FEES.

Matriculation	$5
Tickets for the full year's course of instruction, Freshman or Junior	70
Tickets for the full year's course of instruction, Senior	80
Single tickets for Chemistry, Materia Medica, Botany and Toxicology, each	15
Single tickets for Analytical Chemistry	20
Single tickets for Practical Pharmacy	20
Single tickets for Microscopy	10
Single tickets for Mercantile Pharmacy	5
Single tickets for Pharmaceutical Jurisprudence	5
Fee for Diploma	10

SCHEDULE.

The thirty-fifth annual session of the College will begin on Wednesday, September 26, 1906, and close on Wednesday, June 5, 1907.

Monday.	Tuesday.	Wednesday.
FRESHMEN. Botany. Lectures and Recitations, 10 to 11 a. m. Pharmacy. Lectures and Recitations, 11 a. m. to 12 m. Recess, 12 m. to 1 p. m. Pharmacy. Laboratory Work 1 to 4 p. m.		
JUNIORS. Physics and General Chemistry. Lectures and Recitations, 6 to 7 p. m. Analytical Chemistry. Lectures, Recitations and Laboratory Work, 7 to 11 p. m	SENIORS. Microscopy. Lectures, Laboratory Work and Recitations, 6 to 8 p. m., October 5 to February 12. Mercantile Pharmacy. Lectures and Practice. 8 to 10 p. m., Feb. 12 to End of Term. Pharmaceutical Jurisprudence. 8 to 9 p. m.	FRESHMEN. Physics and General Chemistry. Lectures and Recitations, 6 to 7 p. m. Analytical Chemistry. Lectures, Recitations and Laboratory Work, 7 to 11 p. m.

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The thirty-fifth annual session of the College will begin on Wednesday, September 26, 1906, and close on Wednesday, June 5, 1907.

Monday.	Tuesday.	Wednesday.
FRESHMEN. Botany. Lectures and Recitations, 10 to 11 a. m. Pharmacy. Lectures and Recitations, 11 a. m. to 12 m. Recess, 12 m. to 1 p. m. Pharmacy. Laboratory Work 1 to 4 p. m.		
JUNIORS. Physics and General Chemistry. Lectures and Recitations 6 to 7 p. m. Analytical Chemistry. Lectures, Recitations and Laboratory Work, 7 to 11 p. m.	SENIORS. Microscopy. Lectures, Laboratory Work and Recitations, 6 to 8 p. m., October 5 to February 12. Mercantile Pharmacy. Lectures and Practice 8 to 10 p. m., Feb. 12 to End of Term. Pharmaceutical Jurisprudence. 8 to 9 p. m.	FRESHMEN. Physics and General Chemistry. Lectures and Recitations, 6 to 7 p. m. Analytical Chemistry. Lectures, Recitations and Laboratory Work, 7 to 11 p. m.

SCHEDULE.

Thursday.	Friday.	Saturday.
SENIORS. Materia Medica and Toxicology. Lectures and Recitations, 10 to 11 a. m. Pharmacy. Lectures and Recitations, 11 a. m. to 12 m. Recess, 12 m. to 1 p. m. Pharmacy. Laboratory Work, 1 to 4 p. m.		JUNIORS. Botany and Materia Medica. Lectures and Recitations, 10 to 11 a. m. Pharmacy. Lectures and Recitations, 11 a. m. to 12 m. Recess, 12 m. to 1 p. m. Pharmacy. Laboratory Work 1 to 4 p. m.
JUNIORS. Microscopy Lectures, Laboratory Work and Recitations, 6 to 8 p. m.	SENIORS General and Organic Chemistry. Lectures and Recitations, 6 to 7 p. m. Quantitative Chemical Analysis. Lectures and Recitations, 7 to 11 p. m.	

Entrance examination at 1 p. m. on Thursday, September 20, 1906, in the lecture-room of the College. Annual examination of Freshmen and Juniors for promotion and of Seniors for graduation begins on Monday, May 15, 1906.

PART III.

Boards, Committees, and Auxiliary Organizations.

BOARD OF UNIVERSITY PUBLICATIONS.

THE PRESIDENT, *ex officio*.

PROFESSOR MITCHELL CARROLL, *Director*.
PROFESSOR CHARLES E. MUNROE.
PROFESSOR D. KERFOOT SHUTE.
PROFESSOR WILLIAM R. VANCE.
PROFESSOR C. W. A. VEDITZ.
OTIS D. SWETT, *Secretary*.

The Board of University Publications was organized to have administrative and editorial supervision over the official publications of the University. THE GEORGE WASHINGTON UNIVERSITY BULLETIN is published four times a year as the organ of the educational and scientific activities of the University. The University Catalogue constitutes one number. The Alumni Number, issued in June, is devoted to information regarding the work and plans of the University of especial interest to alumni and patrons. Scientific numbers are published from time to time, containing contributions from instructors and graduates and information regarding books, monographs and papers issued by them under other auspices. A supplement to the University Bibliography appears annually, containing titles of publications for the current year and lists of publications of instructors and graduates not appearing in the 1904 Bibliography.

The Board has also entered upon the publication of papers by instructors in the following groups: Philology and Literature, Philosophy, Science, Law and Jurisprudence, Politics and Diplomacy.

This Board has also general supervision over student publications. These are at present the *University Hatchet*, a weekly newspaper, and the University Annual, known as *The Mall*, which are in charge of an editor-in-chief and business manager, and an editorial board selected from the student body under the direction of the Association of Class Presidents. Annual reports are submitted by the Editor-in-chief and the Business Manager to a committee representing the Class Presidents and the Board of Publications, and after approval are placed on file with the Board.

COMMITTEE ON THE UNIVERSITY LIBRARY.

PROFESSOR CHARLES CLINTON SWISHER, *Chairman*.
PROFESSOR WILLIAM R. VANCE, *Secretary*.
PROFESSOR FRANK H. BIGELOW.
PROFESSOR A. F. A. KING.
PROFESSOR HERMANN SCHOENFELD.

This Committee, consisting of members from the various Faculties, was organized for the purpose of making recommendations in regard to the selection of books for purchase, the expenditure of the Library Fund, and the general administration of the Library.

UNIVERSITY ATHLETICS.

ATHLETIC COUNCIL.

Faculty Members.

CHARLES EDWARD MUNROE, Ph.D., Professor of Chemistry.
THOMAS A. CLAYTOR, M.D., Professor of Materia Medica and Therapeutics.
JOHN PAUL EARNEST, A.M., LL.M., Professor of Law.

Alumni Members.

W. F. R. PHILLIPS, M.D., *Chairman.*
H. T. BRIGHT.
CHAPIN BROWN.
C. M. BEALL, M. D.
BRUCE BULASKI.
H. P. BLAIR.

Undergraduate Members.

E. L. REED, President of the Athletic Association.
H. M. BRADLEY, Captain of Base-ball Team.
D. W. MCENERY, Manager of Base-ball Team.
B. G. STEENERSON, Captain of Foot-ball Team.
E. C. WILSON, Manager of Foot-ball Team.

The Athletic Council has complete control over all athletic sports, subject to the general authority of the President's Council. The Athletic Council is determined annually as follows: The Faculty members are appointed by the President of the University; the President of the Athletic Association (undergraduate organization), and the managers of the base-ball and foot-ball teams are elected annually by the Association; the Alumni members are chosen by the Athletic Council from the Alumni. Each member of the Council has one vote, except the Alumni members, who collectively have three votes. No student is permitted to take part in any athletic contest who is not regularly registered as taking a full course in the University and whose class standing is unsatisfactory. No student is permitted to engage in any contest unless his physical condition is approved by a medical examiner designated by the Council.

INTERCOLLEGIATE DEBATING COUNCIL.

Faculty Members.

C. W. A. Veditz, Ph.D., LL.B., *Chairman.*
Ernest G. Lorenzen, Ph.B., J.U.D.

Alumni Members.

John W. Langley, LL.M.
Henry F. Woodard, LL.B.

Student Members.

Clarence W. Whitmore (Enosinian Society).
Allen G. Flowers (Columbian Society).
John A. Smith (Needham Society).
Leon Shelton (University Congress).

The Intercollegiate Debating Council was created one year ago for the purpose of bringing under systematic control the intercollegiate debating interests of the University. Representation in the Council is given to the Faculty, the Alumni Association, and to the several student debating organizations whose membership is sufficiently large to entitle them to it. All matters pertaining to intercollegiate debates in which The George Washington University is a party fall within the jurisdiction of this Council.

During the past year the students of the University have participated in four intercollegiate debates. On February 5, 1905, George A. Malcom, Carl A. Badger, and William W. Woodwell, with B. F. Rhodes as alternate, represented this University against the University of Virginia. On March 3, 1905, C. W. Whitmore, Wm. C. Van Vleck, and E. P. Gates, of The George Washington University, defeated a team of debaters representing Washington and Lee University. On May 27, 1905, Robert B. Pharr, Leonie Bone, and Samuel Edelstein, with Louis Cohen as alternate, defeated the Georgetown University debaters. On December 9, 1905, Alvin L. Newmyer, Marcus H. Burnstine, and E. P. Gates, with Leon Shelton as alternate, defeated the University of Virginia in debate.

COMMITTEE ON DRAMATIC AND MUSICAL ORGANIZATIONS.

PROFESSOR HOWARD L. HODGKINS, *Chairman*
PROFESSOR MITCHELL CARROLL.
PROFESSOR C. WILLIAM A. VEDITZ.

This Committee has general supervision over dramatic and musical societies organized among the students of the University. Students desiring to form such clubs must submit to the Committee a draft of their proposed undertaking, together with the name of the business manager and a list of prospective members, for the approval of the Committee.

ASSOCIATION OF CLASS PRESIDENTS.

MEAD MOORE, Medicine, '06, *President.*
JAS. D. DODSON, College, '09, *Vice-President.*
CLARENCE A. MILLER, Politics and Diplomacy, *Secretary.*
ROBT. McG. JONES, Law, '08, *Treasurer.*
C. W. WHITMORE, College, '06.
R. BRAGAW, College, '07.
W. J. TURKENTON, College, '08.
J. B. BOGAN, Medicine, '07.
G. H. HART, Medicine, '08.
C. A. SORENSON, Medicine, '09.
J. W. TAYLOR, Dentistry, '06.
G. P. JACKSON, Dentistry, '07.
J. A. GRUBBS, Dentistry, '08.
CARL A. BADGER, Law, '06.
CHAS. F. GERRY, Law, '07.
L. V. LANDRY, Master of Laws, '06.
DELOS H. SMITH, Master of Laws, '07.

The Association of Class Presidents is an organization made up of the Presidents of the various classes in the University. It is thus a truly representative body, and is clothed with sufficient authority to render its actions important and far-reaching. It is through this body that the University authorities are able to keep in close touch with each class in the University and to communicate with them as occasion may require. One of the notable achievements of this organization during the past year was its pioneer work in the establishment of the Board for the Publication of the University Annual, *The Mall*, and putting the same on a permanent basis.

THE GEORGE WASHINGTON UNIVERSITY MEDICAL SOCIETY.

A. B. Hooe, M.D., '96, *President.*
John W. Chappell, M.D., '83. *Vice-President.*
D. Webster Prentiss, Jr., M.D., '99, *Secretary.*
Lewis H. Taylor, M.D., '03, *Treasurer.*

Members of Council.

Henry C. Yarrow, M.D.
J. Lewis Riggles, M.D., '00.
T. N. McLaughlin, M.D., '82.
T. A. Groover, M.D., '98.
Samuel Frye, M.D., '02.

The following extract from Article I of the constitution shows the scope and intent of the Society:

"Section 1. The name of this organization shall be The George Washington University Medical Society.

"Section 2. The object of this society shall be: The consideration and advancement of medical science, the cultivation and perpetuation of closer friendly and social relations between the Alumni of the Department of Medicine, and the general promotion of the interests and welfare of the University in all its departments."

All graduates of the Department of Medicine are eligible to membership. Two classes of members are recognized, (*a*) active members, who must be residents of the District of Columbia, and (*b*) non-resident members, alumni of the Department outside of the District of Columbia. Active members pay annual dues of $4.00, non-resident members pay annual dues of $1.00. The Society meets in the Medical Building on the third Saturday of every month from October to May, both inclusive. Correspondence should be addressed to the Secretary, Dr. D. Webster Prentiss, Jr., 1315 M street, N. W.

CLUBS.

Important work is done by students in Clubs organized in connection with various departments of instruction. These organizations include the following:

1. The Classical Club, monthly.
2. The Architectural Club, monthly.
3. Civil Engineering Society.
4. The Electrical Club
5. The Mechanical Engineering Society.

ALUMNI ASSOCIATIONS.

THE GENERAL ASSOCIATION.

Officers, 1905-1906.

President.

William Bruce King.

Vice-Presidents.

Dr. George N. Acker.
Aldis B. Browne.
John Paul Earnest.
John Joy Edson.
Henry F. Woodard.
Myer Cohen.

Secretary.
Howard L. Hodgkins.

Treasurer.
John B. Larner.

Executive Committee.

William Bruce King, Chairman.
Howard L. Hodgkins, Secretary.

Dr. George N. Acker.
Dr. C. W. Appler.
Aldis B. Browne.
Myer Cohen.
Wlliam A. DeCaindry.
John T. Doyle.
John Paul Earnest.
John Joy Edson.
J. W. Holcombe.
Dr. A. F. A. King.
John W. Langley.
John B. Larner.
Dr. T. N. McLaughlin.
Stanton C. Peelle.
Mason N. Richardson.
Henry F. Woodard.

PUGET SOUND ALUMNI ASSOCIATION.

President.
Charles F. Munday.

Vice-President.
Willis B. Herr.

Secretary and Treasurer.

William E. McClure,
Dexter Horton Bank Building, Seattle, Washington.

COLORADO ALUMNI ASSOCIATION.

President.
Lucius M. Cuthbert.

Vice-President.
Herbert L. McNair.

Secretary and Treasurer.

Clarence A. Brandenburg,
501 Equitable Building, Denver, Colorado.

SALT LAKE CITY ALUMNI ASSOCIATION.

President.
DR. WILLIAM F. BEER.

Vice-President.
MAURICE M. KAIGHN.

Secretary.
C. L. OLSON.

Treasurer.
J. E. WILLEY.

NEW YORK ALUMNI ASSOCIATION.

President.
FRITZ V. BRIESEN.

Secretary.
OLIVER C. CARPENTER.
52 William Street, New York City.

SOUTHERN CALIFORNIA ALUMNI ASSOCIATION.

President.
JAMES R. ROGERS.

Secretary.
GEORGE RUSSELL DUNCAN,
328 South Spring Street, Los Angeles, Cal.

From 1821 to 1905 the University conferred 6,378 degrees upon 5,016 persons. A list of graduates is kept at the University by the Secretary of the General Alumni Association, and contains the names, occupations, and addresses of more than 3,200 living graduates. All Alumni are requested to send to him notices of changes in address and any other items of information and interest in reference to graduates or former students of the University.

THE COLUMBIAN WOMEN.

President.
MISS EMMA HARPER TURNER.

First Vice-President.
MRS. WM. REYNOLDS VANCE.

Second Vice-President.
MISS JULIA MCMILLAN.

Recording Secretary.
MISS CATHERINE MCILHENNY.

Corresponding Secretary.
MISS M. A. CLANCY.

Treasurer.
MISS REBECCA E. SHANLEY.

Historian.
MISS AMY G. THOMPSON.

The Columbian Women, an oragnization composed of Alumnæ, wives of Trustees and members of the Faculty, and women students of the University, was formed in 1894 for the advancement of

women, by founding for them scholarships in the University, and for the promotion of the general interests of the University. In recent years it has devoted itself mainly to collecting funds for a scholarship to be known as "The Columbian Women Scholarship." They have also raised money for the University Hospital and for reference books for the Library.

BOARD OF LADY MANAGERS OF THE GEORGE WASHINGTON UNIVERSITY HOSPITAL.

President.

Mrs. Howard L. Hodgkins.

First Vice-President.

Mrs. Charles J. Bell.

Second Vice-President.

Mrs. H. C. Yarrow.

Recording Secretary.

Mrs. Edward Bennett Rosa.

Corresponding Secretary.

Mrs. W. McK. Stowell.

Treasurer.

Mrs. S. E. Lewis.

The Board of Lady Managers of the University Hospital was formed at the inception of the Hospital, in 1898, to act as "a Board of Visitors, with power to raise money for the Hospital, and with such powers and duties in connection with the purchase of supplies and equipment as are assigned them by the President." The Board consists of ninety women, who meet monthly to consider the various needs of the Hospital and to plan how best to meet them. The equipment of the enlarged building for the Hospital was due chiefly to the energies of this Board.

GEORGE WASHINGTON MEMORIAL ASSOCIATION.

President.

Mrs. Archibald Hopkins.

Vice-Presidents.

Mrs. Charles D. Walcott.
Mrs. Henry Mallory.
Miss Bessie J. Kibbey.
Mrs. Charles J. Bell.
Mrs. Fred B. McGuire.
Miss Alice Risley Seward.

Corresponding Secretary.

Mrs. J. Hubley Ashton.

Recording Secretary.

Mrs. Susanna Phelps Gage.

Treasurer.

Mrs. Frank Northrup.

Trustees.

The George Washington Memorial Association, incorporated September, 1898, is a body of patriotic women representing different parts of the United States, who organized with a view to memorialize Washington's idea of a national institution and to provide a building for scientific research and graduate study. The objects of the Association, stated in the charter, are "to advance and secure the establishment in the city of Washington of an university for the purposes and with the objects as substantially set forth in and by the last will of George Washington, the first President of the United States, and to increase the opportunities for higher education of the youth of the United States."

In the spring of 1904 the Trustees of Columbian University accepted the change of name suggested by the George Washington Memorial Association and its offer to erect on the new site a memorial building for graduate study and scientific research.

SCIENTIFIC SOCIETIES IN WASHINGTON.

Professors and instructors in the University are, with few exceptions, members of one or more of the following learned bodies:

1. The Washington Academy of Sciences.
2. The Anthropological Society of Washington.
3. The Archæological Institute of America, Washington Society.
4. The Biological Society of Washington.
5. The Botanical Society of Washington.
6. The Chemical Society of Washington.
7. The Entomological Society of Washington.
8. The National Society of the Fine Arts.
9. The Society of American Foresters.
10. The National Geographic Society.
11. The Geological Society of Washington.
12. The Columbia Historical Society.
13. The Medical Society of the District of Columbia.
14. The Philosophical Society of Washington.
15. The Society for Philosophic Inquiry.
16. The Washington Economic Society.
17. The Washington Society of Engineers.
18. American Institute of Electrical Engineers, Washington Branch.

PART IV.

STUDENTS IN THE UNIVERSITY.

Students in the University.

DEPARTMENT OF ARTS AND SCIENCES.

GRADUATE STUDIES.

Master of Arts.

Name.	Legal residence.	City address.
Bays, William Webb	Ga.	The Geo. Wash. Univ.
A.B., 1904, Washington and Lee University. *Topics*—Major, English 27; Minors, German (Faust), French 21.		
De Forest, Augusta Moulton	Kans	49 Rhode Island Ave.
B.A., 1905, The George Washington University. *Topics*—Major, French; Minors, French, Spanish.		
Edler, August Friedrich Wilhelm	Germany.	1635 13th Street.
Topics—Major, Germanics; Minors, History, International Law.		
Heartsill, Francis Parham	Texas	1820 9th Street.
B.A., 1903, New York University. *Topics*—Major, Latin 42; Minors, English 27, Mathematics 41 and 43, Archæology 21*a*.		
McPherson, Maud Esther	Ill.	1250 Princeton Street.
B.A., 1905, The George Washington University. *Topics*—Major, English 44; Minors, English 27, German 3, (Auditor, Spanish 1).		
Moore, Robert Irwin	Tenn.	Chevy Chase College.
B.A., 1898, Vanderbilt University. *Topics*—Major, History 21; Minors, Latin 43, Economics 20.		
Owens, Rev. Oscar Lee	Md.	St. James.
B.D., 1905, Rochester Theological Seminary. Richmond College, 1898. *Topics*—Major, English 55; Minor, Philosophy 44.		
Paddock, Ernest Moorehead	Penn	1723 H Street.
B.A., 1894, University of Pennsylvania. Graduate, 1897, Episcopal Theological School, Cambridge, Mass. *Topic*—Philosophy.		
Russell, Alice Dyar	Minn.	410 N. J. Avenue, S. E.
B.A., 1903, Minnesota State University. *Topics*—Major, Sociology 20; Minors, Economics 21, Philosophy 25.		
Shields, Walter Clement	Penn	1335 Connecticut Ave.
B.A., 1904, Moravian College, Bethlehem, Pa. *Topics*—Major, English 53; Minors, English 27, English 44.		
Spencer, Nellie Scribner	D. C.	1339 Wallach Place.
B.A., 1901, Hiram College. *Topics*—Major, English; Minor, Archæology.		
Turner, Mary Elsie	D. C.	414 B Street, N. E.
B.A., 1902, Columbian University. *Topics*—Major, Latin; Minors, Archæology, Æsthetics.		

Master of Science.

Name.	Legal residence.	City address.
Allen, Leslie Lyle	N. C.	1931 K Street.
B.E., 1900, A. and M. College, North Carolina. *Topics*—Major, Applied Mathematics; Minors, Pure Mathematics, Descriptive Geometry.		
Coope, Harry	Ohio.	706 11th Street.
B.S., 1905, The George Washington University. M.P.L., 1901, Columbian University. LL.B., 1899, LL.M., 1900, National University. *Topics*—Major, Money and Banking; Minors, Public Finance, Corporation Finance.		
Dawson, Edward Matthews, Jr.	D. C.	1752 S Street.
B.S., 1905, The George Washington University. *Topics*—Major, History 24; Minors, History 21, History 40.		
Gilbert, Walter Merwin	N. Y.	Carnegie Institution.
B.S., 1899, College of City of New York. *Topics*—Major, Philosophy 24; Minors, English 27, Philosophy 41.		
Graves, Sheldon Heber	Vt.	1221 K Street.
B.S., 1904, Columbian University. *Topics*—Major, Physical Chemistry; Minors, Stereo-Chemistry, Applied Mathematics 20.		
Hoover, George William	Okla.	1921 13th Street.
B.S., 1903, Oklahoma Agricultural College. *Topics*—Major, Organic Chemistry; Minors, Bacteriology, Physiology.		
MacDonald, Donald Francis	Wash.	Geological Survey.
B.S., 1905, University of Washington. *Topics*—Major, Economic Geology; Minors, Paleontology, English 27.		
Mitchell, Evelyn Groesbeeck	N. Y.	813 T Street.
B.A., 1902, Cornell University. *Topics*—Major, Ichthyology; Minors, Systematic and Morphological Entomology.		
Owen, Frederick Denison	Conn.	3 Grant Place.
B.S., 1905, The George Washington University. *Topics*—Major, Civil Engineering 21; Minors, Archæology 21, Philosophy 47.		
Pistorio, Irene Mabel	D. C.	2142 G Street.
B.S., 1904, The George Washington University. *Topics*—Major, Architectural Design; Minors, Archæology, Composition of Architecture.		
Smith, Delos Hamilton	Ariz.	1905 F Street.
Topics—Major, Architectural Design; Minors, Architecture 30, 20, and 40.		
Swett, Otis Dow	Md.	Chevy Chase.
LL.B., 1891, LL.M., 1892, B.S., 1904, Columbian University. *Topics*—Major, Chemistry; Minors, Electro-Chemistry, Stereo-Chemistry.		

Civil Engineer.

Name.	Legal residence.	City address.
Dunstan, Edwin Vivian	Va.	24 M Street, N. E.

B.S. in C.E., 1905, The George Washington University.
Topics—Major, Hydraulic Engineering; Minors, Mechanical Engineering 43 I, Civil Engineering 46.

Mechlin, Oscar Alexander .... D. C.... 3020 Cambridge Place.
B.S., 1903, Dartmouth College.
Topics—Major, Civil Engineering 40; Minors, Civil Engineering 21, 41 and 46.

Electrical Engineer.

Gregory, Charles Nichols... .... N. Y.... 302 C Street.
B.S. in E.E., 1905, The George Washington University.
Topics—Major, Electric Power Plant Design; Minors, Mechanical Engineering 23; Electrical Engineering, 42.

Matthews, James Muscoe............ Va. .... 1109 17th Street.
B.S. in E.E., 1905, The George Washington University.
Topics—Major, Electric Power Plant Design; Minors, Mechanical Engineering 23; Electrical Engineering 42.

Mechanical Engineer.

Albert, Frederick Wilhelm .... Penn... 2307 32d Street.
B.S. in M.E., 1905, The George Washington University.
Topics—Major, Mechanical Engineering 25; Minors, Mechanical Engineering 43; Electrical Engineering 40.

In Attendance.

Donk, Marion Gilbert............... Fla..... 1736 G Street.
B.A., 1898, Florida Agricultural and Mechanical College; A.B., 1901, Harvard.
Topics—Graphics 8, Civil Engineering 4.

Kerr, Robert Howard............... Md.... College Park, Md.
B.S., 1903, Oklahoma Agricultural and Mechanical College.
Topic—Chemistry 24.

Lamson, Eleanor Annie............. D. C.... 2439 18th Street.
B.S., 1897, M.S., 1899, Columbian University.
Topic—Physics, 42.

Sinclair, Joseph Henry.............. N. Y... 1825 F Street.
B.A., 1902, University of Rochester.
Topic—Integral Calculus.

Taber, Walter C.................... Cal. .... Bureau of Soils.
B.A., 1898, Leland Stanford, Jr., University.
Topics—Chemistry 26; Geology 1.

Doctor of Philosophy.

Name.	Legal residence.	City address.
Alden, Levi Russell..................	D. C....	809 L Street.
B.A., 1903, M.A., 1904, Columbian University. *Topics*—Major, American History; Minors, History of English Law, Mediæval History.		
Backus, Cyrus Day............. ...	N. Y....	U. S. Patent Office.
Ph.B., 1896, LL.B., 1896, Cornell University; B.S., 1904, Columbian University; M.S., 1905, The George Washington University. *Topics*—Major, Electrical Engineering; Minors, Physics 22, Chemistry 25.		
Boettcher, Frederick L. J............	Va......	1211 G Street, N. E.
B.S., 1894, M.S., 1895, Columbian University. *Topics*—Major, Micro-chemistry; Minors, Biology, Chemistry 23, 24.		
Brodthage, Rev. George.......	Germany.	320 4½ Street, S.W.
Maturity for University studies, Strassburg; 12 semesters University of Strassburg, Berlin, Göttingen. *Topics*—Major, Germanics; Minors, History, Philosophy.		
Church, Calvin Grant.....	Md.....	111 12th Street, S. E.
B.S., 1900, Maryland Agricultural College. M. S., 1902, Columbian University. *Topics*—Major, Agricultural Chemistry; Minors, Physical Chemistry, Analytical Chemistry.		
Clark, Marion	Md.....	Cecilton, Md.
B.A., 1901; M.A., 1903, Western Maryland College. *Topics*—Major, American History; Minors, Constitutional Law, International Law.		
Day, Herbert Ernest................	D. C....	Kendall Green.
Ph.B., 1893, Brown University. M.A., 1895, Gallaudet College. M.A., 1901, Columbian University. *Topics*—Major, American History; Minors, English History, American Literature.		
Doan, Mary......	Ind.....	10th St. and Grant Pl.
B.S., 1891, M.S., 1893, Purdue University. B.L., 1892, Earlham College. *Topics*—Major, English Literature; Minors, Sociology, Philosophy.		
Doyle, Aida Mary.............	Penn...	1123 Dartmouth Street.
B.S., 1898, M. S., 1899, Columbian University. *Topics*—Major, Chemistry; Minors, Agricultural Chemistry, Geology.		
Grover, Frederick Warren...........	Mass. ..	409, The Ontario.
B.S., 1899, Massachusetts Institute Tech. M.S., 1901, Wesleyan University. *Topics*—Major, Physics; Minors, Mathematics, Physical Chemistry.		

Name.	Legal residence.	City address.
Hall, Percival	Md.	Kendall Green.

B.A., 1892, Harvard; M.A., 1893, Gallaudet College; M.D., 1890, Columbian University.
Topics—Major, Pure Mathematics; Minors, Applied Mathematics, Astronomy.

Hinman, Ida........................ Iowa ... 1529 Q Street.
B.S., 1892, A.M., 1902, Columbian University.
Topics—Major, English; Minors, German, French.

Huidekoper, Frederic Louis .... D.C.... 1614 18th Street.
A.B., 1896, Harvard.
Topics—Major, European History; Minors, English History from 1784 to 1885.

Hyde, William Albert............ ... Conn... 1225 Yale Street.
Ph.B., 1901, Yale University.
Topics—Major, Physics, 43; Minors, Mathematics 41, Electro-Chemistry, 26.

Kimball, Herbert Harvey............ N. H... 2235 13th Street.
B.S., 1884, N. H. C. A. and M. A.
M.S., 1900, Columbian University.
Topics—Major, Astro-Physics; Minors, Meteorology, Practical Meteorology.

Ludlow, Clara Southmayd. .... D.C.. .. 2214 Penna. Avenue.
B.S., 1900, M.S., 1901, A. and M. Coll. Miss.
Topics——Major, Preventive Medicine; Minors, Histology, Physiology, (Human) Anatomy, Bacteriology and Pathology.

Lyon, Marcus Ward, Jr.............. N. J.... National Museum.
Ph.B., 1897, Brown University; M.S., 1900; M.D., 1902, Columbian University.
Topics—Major, Zoölogy; Minors, Neurology, Histology.

McBryde, Charles Neil .... Va..... 1521 K Street.
B.S., 1891, University of S.C.; B.S., 1892, Va. Polytech. Inst.; M.D., 1897, Johns Hopkins.
Topics—Major, Geology; Minors, Mineralogy, Botany.

Marsh, Millard Caleb................ N. Y... 1336 Massachusetts Ave.
B.S., 1897, Cornell; M.S., 1905, The George Washington University.
Topics—Major, Chemistry 41; Minors, Bacteriology, Bio-Chemistry.

Marshall, Elmer Eugene .... D.C.... 1327 Newton Street.
B.A., 1889, Ohio Wesleyan University; S.T.B., 1904, Boston University.
Topics—Major, History 40; Minors, Philosophy 44 and 25, Biblical Literature.

Mattern, Louis Wilson............... Penn... McKinley School.
B.S., 1894, Pa. State College.
Topics—Major, Chemistry; Minors, Bio-Chemistry, Physical Chemistry.

Name.	Legal residence.	City address.
Mills, Joseph Strayer	Md.	Central High School.
B.A., 1890; M.A., 1893, Western Maryland College. *Topics*—Major, Chemistry; Minors, Mineralogy, Physics.		
Monaghan, James Charles	Wis.	1335 F Street.
B.A., 1885, M.A., 1903, Brown University. *Topics*—Major, German Literature; Minors, Constitutional Law, International Law.		
Newberne, Robert Edward Lee	Texas	914 New York Avenue.
M.D., 1893, Georgetown University. D.D.S., 1898, Tacoma College Dental Surgery. B.S., 1901, M.S., 1901, Columbian University. *Topics*—Major, Neurology; Minors, Anatomy, Physiology.		
Newton, Elmer Slayton	Mass.	Rm. 64, The Brunswick.
B.A., 1895, Amherst. M.D., 1905, The George Washington University. *Topics*—Major, Bio-Chemistry; Minors, Bacteriology and Organic Chemistry.		
Orth, Henry, Jr.	D. C.	1011 L Street.
M.E., 1893, Lehigh. M.S., 1899, Columbian University. *Topics*—Major, Physical Chemistry; Minors, Organic Chemistry, Theoretical Chemistry.		
Outwater, Raymond	D. C.	1312 B Street, S.W.
B.S., 1904, Columbian University. M.S., 1905, The George Washington University. *Topics*—Major, Chemistry 41; Minors, Chemistry 22, Bacteriology.		
Patrick, George Edward	Iowa	Dept. of Agriculture.
B.S., 1893, M. S., 1894, Cornell University. *Topics*—Major, Agricultural Chemistry; Minors, Bacteriology, Bio-Chemistry.		
Peake, James Frederick	Va.	616 9th Street, N. W.
B.A., 1902, Randolph Macon College. M.A., 1904, Columbian. *Topics*—Major, American History 24; Minors, Latin, English.		
Portner, Edward George	D. C.	Alexandria, Va.
B.S., 1897, M.S., 1898, Columbian University. *Topics*—Major, Chemistry; Minors, Physical Chemistry, Mineral Chemistry.		
Richards, Luther Adolph	Va.	1100 N. Y. Avenue.
B.A., 1902, M.A., 1903, M.S., 1904, Columbian University. *Topics*—Major, Astronomy; Minors, History of Astronomy, Solar Physics.		

Name.	Legal residence.	City address.
Richardson, Edward Elliott	D. C.	400 7th Street, S. W.
M.D., 1895, B.S., 1904, Columbian University. M.S., 1905, The George Washington University. *Topics*—Major, Rational Psychology; Minors, Neurology, Physiology, Experimental Psychology.		
Robertson, Benjamin Perry	Md.	1116 N. Fulton Av., Balto.
M.A., 1899, Judson College, N. C. M.A., 1902, Columbian University. Th.M., 1892, S. B. T. Seminary, Louisville. *Topics*—Major, Biblical Literature; Minors, Psychology, Sociology.		
Shear, Cornelius Lott	Md.	Dept. of Agriculture.
B.S., 1896, A.M., 1900, University of Nebraska. *Topics*—Major, Botany; Minors, Botany, Geology.		
Simon, Abram	D. C.	2606 University Place.
Rabbi, 1894, Cincinnati Hebrew Union College. B.L., 1894, Cincinnati University. *Topics*—Major, Philosophy; Minors, English Literature, Biblical Literature.		
Snelling, Walter Otheman	Mass.	3412 13th Street.
B.S. in Chem., 1904, Columbian University. B.S., Gen. Sci., 1905, Harvard. *Topics*—Major, Chemistry; Minors, Advanced Geology, Chemistry of the Rare Earths.		
Solyom, Herbert Louis	Md.	U. S. Patent Office.
B.S., 1902, M.S., 1903, Columbian University. *Topics*—Major, Astro-Physics; Minors, Economics, Meteorology.		
Stiles, George Whitfield, Jr.	Okla.	25½ Bates Street.
B.S., 1900, Oklahoma Agricultural and Mechanical Coll. M.D., 1905, George Washington University. *Topics*—Major, Bacteriology; Minors, Bio-Chemistry, Practice of Medicine.		
Stockberger, Warner Webster	Ohio	3628 Morgan Avenue.
B.S., 1902, Denison University. *Topics*—Major, Botany; Minors, Botany, Zoölogy.		
Straughn, Martin Norris	Md.	College Park, Md.
B.S., 1899, Maryland Agricultural College. M.S., 1902, Columbian University. *Topics*—Major, Chemistry 45; Minor, Chemistry.		
Thurston, Ernest Lawton	D. C.	1449 Kenesaw Avenue.
C.E., 1893, Columbian University. *Topics*—Major, Applied Mathematics; Minors, Graphic Statics, Differential Equations.		
Waring, Luther Hess	Pa.	2816 Brightwood Avenue.
B.A., 1905, The George Washington University. M.A., 1904, Columbian University. 1896, Graduated from Lutheran Theological Seminary. *Topics*—Major, German History; Minors, Philosophy, Political Science.		

Name.	Legal residence.	City address.
Welsh, John Cleveland	Tenn	229 F Street N. E.
B.S., 1887, Carson and Newman College. M.S., 1902, Columbian University. *Topics*—Major, Botany; Minors, Chemistry, Zoölogy.		
Wilkinson, Benjamin George	D. C.	Takoma Park, D. C.
B.A., 1897, University of Michigan. M.A., 1905, Union College. *Topics*—Major, History 45; Minors, American History, English History.		
Wilkinson, Oscar	Miss.	1404 L Street.
M.D., 1896, Tulane University. Ph.B., 1902, University of Mississippi. M.A., 1903, Columbian University. *Topics*—Major, Physiological Optics; Minors, Therapeutics, Practice of Medicine.		
Wilson, Harold Henry	Mo.	Washington Barracks.
B.A., 1902, M.A., 1904, Park College, Mo. *Topics*—Major, Botany; Minors, Zoölogy, Bacteriology.		
Witherspoon, Thomas Alfred	Tenn	U. S. Patent Office.
1883, Graduated from U. S. Naval Academy. LL.B., 1891, M.S., 1897, Columbian University. *Topics*—Major, Physical Chemistry; Minors, Chemistry, Electricity.		
Woodward, Sherman Melville	Arizona.	Department of Agric.
M.S., 1893, Washington University, St. Louis. M.A., 1896, Harvard University. *Topics*—Major, Hydrodynamics; Minors, Mechanical Engineering, Relation between Precipitation and Run-off on Watersheds.		

COLUMBIAN COLLEGE.

Bachelor of Arts.

Name.	Legal residence.	City address.
Adams, Vera Elsie	D. C.	503 B Street, N. E.
Allis, Frank Coy	N. Y.	936 K Street.
LL.B., 1903, Cornell University.		
Barber, Clara Velma	Fla.	703 East Capitol Street.
Barbour, Grace Evelyn	D. C.	1327 12th Street, N. E.
Bethune, Frances Gunby	Va.	The California.
Birch, Mary Simpson	Va.	1107 Lydecker Avenue.
Birtwell, Bertha	Pa	15 8th Street, N. E.
Block, Karl Morgan	D. C.	145 11th Street, N. E.
Bodmer, Annie Elizabeth	D. C.	1325 1st Street, S. W.
Brashears, Irma	D. C.	3560 13th Street.
Brookes, John Saint Clair, Jr.	D. C.	1323 Corcoran Street.
Brown, Robson De S.	Iowa	503 S Street.
Bulloch, Archibald Irvine	Ga	828 13th Street.

Name.	Legal residence.	City address.
Burgdorf, Ada Belle	D. C.	512 6th Street.
Burkett, John M	Ind	1907 H Street.
LL.B., 1905, The George Washington University.		
Burroughs, Elizabeth Harding	D. C.	515 7th Street, S. E.
Capell, Isabel Rhoda	N. Y.	471 H Street.
Cash, Lilian Claire	D. C.	22 Tennessee Ave., N. E.
Church, Christine Merrick	D. C.	626 N. C. Ave., S. E.
Cochran, Ruth Gilbert	Colo.	2464 Wisconsin Avenue.
Conner, Lulu Elizabeth	D. C.	Station 47.
Cooke, May Thacher	Colo.	1328 12th Street.
Corson, Edna Lois	D. C.	1154 17th Street.
Cragin, Harry Seymour	D. C.	1210 Massachusetts Ave.
Craig, Marion Edith	Va.	Floris, Va.
Crawford, Angus McDonald	Va	Alexandria, Va.
Domeratzky, Louis	N. Y.	1335 F Street.
Earl, Merritt	Wis	Office of Indian Affairs.
Edler, August Frederick Wilhelm	Germany	1635 13th Street.
Ellis, Ethel Dean	D. C.	1330 Massachusetts Ave.
Essick, Blanche Lillian	D. C.	105 Kentucky Avenue.
Ettenger, Annie Lee	Ind.	1507 Grant Street.
Evans, Helen Marie	D. C.	2227 13th Street.
Farrington, Charlotte Raynsford	Minn.	3014 Irving Place.
Farwell, Clarence Gilbert	Mass	1458 Corcoran Street.
Field, Ruth Genevieve	Wis.	111 11th Street, S. E.
Fosselman, John J.	Penn	Bureau of Education.
Gates, Edward Percy	Ark	3506 Center Street.
Gillespie, Frances Elma	Texas	The Varnum.
Hall, Mark Anthony	Iowa	606 The Sherman.
Haslup, Alice Elma	Md	1322 I Street.
Hayes, Edwin	Md	Baltimore, Md.
Hazard, Edna Gretchen	D. C.	1488 Chapin Street.
Hubbard, Elbert Hamilton	Iowa	Hamilton Hotel.
Kaufman, Juanita	D. C.	1313 Rhode Island Ave.
Kelly, Edward James	Mich	623 19th Street.
Longfellow, Charles Fay	Ill	The Iowa.
M.D., 1904, Jefferson Medical College.		
McAvoy, Catherine Agatha	D. C.	1917 17th Street.
McCleary, Ethel Hanna	D. C.	217 I Street.
McCoy, Louise Winifred	D. C.	328 E Street, N. E.
McCoy, Marion Elizabeth	Dak	1014 B Street, N. E.
MacMullen, Edgarda Marion	Penn	107 2d Street, N. E.
Mahan, Jane	W. Va.	1250 Columbia Road.
Marye, Tench Tilghman	D. C.	1526 29th Street.
Merrill, Anne Margaret	Maine	1422 Staughton Street.

Name.	Legal residence.	City address.
Merritt, Pearl Ketcham	Minn	154 F Street, S. E.
Morrow, James Benjamin	D. C.	3123 13th Street.
Moyer, Jennie	D. C.	610 8th Street, N. E.
Newhouser, Roy Lyman Joseph	Pa	127 6th Street, S. E.
Newton, Margaret	D. C.	1625 R Street.
Pearce, Anna Elizabeth	D. C.	1425 35th Street.
Peet, Elizabeth	N. Y	Kendall Green.
Person, Ellen Bertha	S. Dak.	3030 Q Street.
Powers, Edgar Cordell	Md.	Brightwood Park, D. C.
Prince, George Washington	Ill.	3113 13th Street.
Raber, Katherine May	Ohio	1123 13th Street.
Reinke, Charlotte	Texas	The Iowa.
Ridout, Edith Heiskill	D. C.	1517 Corcoran Street.
Ross, Margery	Penn	Fairmont Seminary.
Salsbury, Annis	Va.	816 18th Street, N. W.
Schoenfeld, Hans Frederick Arthur	D. C.	1629 Howard Avenue.
Scott, Mabel Lavinia	D. C.	1455 Binney Street.
Sebree, Jessie Lydia	D. C.	327 Delaware Ave., N. E.
Sherier, James Thomas	D. C.	Conduit Road.
Sherman, Dorothea Foote	Va.	428½ M Street.
Singleton, Ogle Ridout	D. C.	2020 H Street.
Smith, Louise Jane	W. Va.	513 B Street, N. E.
Sniffin, William Webb	D. C.	312 N. C. Ave., S. E.
Stansbury, Blanche Gertrude	Va	Alexandria, Va.
Stauffer, May Katharine	Penn	3238 N Street.
Stevens, Clella Lucile	Penn	641 B Street, N. E.
Stuart, Maud Hascall	Mich.	123 11th Street, N. E.
Suit, Florence Eugenia	Md	2016 G Street
Swartwout, Jessamine Eliza	D. C.	12 Iowa Circle.
Swett, Annie Kate	D. C.	1822 9th Street.
Taylor, Adele Ria	N. Y.	2705 P Street.
Van Vleck, William Cabell	D. C.	800 E Street, N. E.
Watkins, Rhoda	Penn.	1412 14th Street.
Wells, Rosa King	N. C.	430 3d Street, N. W.
White, Emilie Margaret	Vt	2568 University Place.
Whitmore, Clarence Willard	D. C.	807 1st Street.
Young, Ruth Bell	Va	Ballston, Va.

Bachelor of Science.

Alden, Anna Grace	D. C.	809 L Street.
Allen, Nila Frances	Ind.	323 Md. Avenue, N. E.
Austin, Ella Morgan	W. Va.	1223 L Street.
Barnum, William Horatio	N. Y.	Carnegie Institution.
Behrend, Esther May	D. C.	1214 K Street.
Besselievre, Nellie Ecker	Pa	315 E Street, N. E.

Name.	Legal residence.	City address.
Biscoe, John Edward Graduate, Virginia Military Institute.	D. C.	813 21st Street.
Bond, Eugene Webster	Ill.	The Baltimore.
Brandenburg, Joseph Franklin	D. C.	915 French Street.
Carter, James Roy	Mich	1115 N Street.
Claflin, Elsie Grace	D. C.	1117 O Street.
Coblenzer, Elsa	D. C.	The Lenox.
Cochran, Mildred Winans	D. C.	2464 Wisconsin Avenue.
Crawford, Mary Page	Va	2026 North Capitol St.
Crocker, Howard De Coit	Va.	Navy Department.
Curl, Joseph Ryland	D. C.	2312 I Street.
Dahn, Franz Frederick William	Minn	1211 B Street, S. E.
Field, Eva Cornelia	Wis	111 11th Street, S. E.
Greene, Olive Wirt	Ill	12 I Street, N. E.
Harper, Minnie	D. C.	619 G Street.
Harrington, Katherine	D. C.	Conduit Road.
Hathaway, Lillie Theresa	Ohio	1600 Park Street.
Hifton, Harriette Jeanne	N. J.	634 East Capitol Street.
Hornaday, Frank A.	Texas	615 5th Street, N. E.
Johnson, Clara Elizabeth	Ind	706 11th Street.
Johnston, Mildred Floyd	D. C.	1762 N Street.
Keathley, Lillie	N. C.	1824 California Avenue.
Kramer, Stephen	D. C.	1318 S Street.
Lamb, William Ers	D. C.	1322 I Street.
Lawton, William Henry	D. C.	2024 H Street.
McMahon, Margaret Agnes	N. Y	1611 13th Street.
Macmillan, Julia Theckla	D. C.	600 Md. Avenue, N. E.
Mechlin, Ernest Frederick	D. C.	3020 Cambridge Place.
Miller, Alvin Wilson	D. C.	2914 N Street.
Morgan, Elonzo Tell	W. Va.	1108 8th Street.
Mosher, Edith R.	Mich	1337 L Street.
Nicholson, Percival Harford	Md.	309 5th Street, S. E.
Phillips, Adon Daniel	N. Y.	1702 4th Street.
Purcell, Robert Blaine	Va.	415 Florida Avenue.
Reavis, Andrew Bryant	Tenn	3525 Eslin Avenue.
Richardson, Sarah May	D. C.	1308 U Street.
Root, Emeretta G.	Utah	1004 Whitney Avenue.
Rowley, Clifford Alonzo	Kans	321 5th Street, S. E.
Saunders, Marie K	Okla	The Brunswick.
Seiler, Justin Frank	Ohio	1013 B Street, N. E.
Shackelford, Laura	D. C.	924 Maryland Ave., N. E.
Smoot, Charles Calvert	Va.	Alexandria, Va.
Sperry, John Robertson	Ill.	1358 Yale Street.
Sprowls, Allen Donald	D. C.	245 10th Street. N. E.
Steever, Laura Winfield	Md.	1333 F Street.

Name.	Legal residence.	City address
Thompson, Oscar	Wis	1829 G Street.
Triepel, Emma Mathews Vaughan	N. C.	780 Harvard Street.
Van Doren, Emma May	D. C.	629 Mass. Ave., N. E.
Voss, Edna Renard	D. C.	1300 Lydecker Avenue.
Wright, Clarence Aldro	D. C.	1829 Kalorama Avenue.
Wychgel, Ettina Gerhardina	N. Y	922 14th Street.
Young, George Le Roy	N. Y.	635 Maryland Ave., N.E.

Bachelor of Science in Chemistry.

Crowe, John Joseph	D. C.	Bladensburg Road.
Fuller, Aubrey Vail	D. C.	2318 1st Street.
Gourley, George Frederick	Md	U. S. Pension Agency.
Houghton, Harry Wilson	Md	B. of C., Dept. of Agr.
Hubbard, Prevost	D. C.	1804 17th Street.
Marsh, Allen	Ohio	628 E Street.
Meyer, Will Beck	D. C.	609 P Street.
Mulroy, James Garfield	N. Y	1614 Swann Street.
Munroe, Russell Barker	D. C.	The Valois.
Orton, Warren	D. C.	16 Florida Ave., N. E.
Parker, Charles Edwin	N. J.	1631 Fairmont Street.
Pohlmann, Joseph John.	N. Y	2917 Olive Avenue.
Sherwood, Sidney Forsythe	Va.	218 N. Patrick St., Alex.
Smith, Edwin, Jr	Md.	Rockville, Md.
Smith, William Bradford	Mass	1208 M Street.
Reed, Edward Oliver	D. C.	1216 S Street.
Wilson, Clarence Paret	Md	Hyattsville, Md.

Bachelor of Science in Politics.

Hamm, Theodore Cushing.	Cal.	922 14th Street.

Special.

Adams, Frank Samuel	S. C	1018 12th Street.
Adams, Mary Lee	S. C.	1018 12th Street.
Alger, William E	N. Y.	639 F Street, N. E.
Allen, Ralph Palmer	N. J.	1523 N. H. Avenue.
Anderson, Henry Melville	Ala.	2009 G Street.
Arnall, Emma Broocks	Texas	1923 K Street.
Beckwith, Sarah Laura	Ga.	1115 O Street.
Blake, Charles Glenville	D. C.	1515 31st Street.
Boshard, John Albert	Utah	1503 12th Street.
Bowker, Charles Harvey	N. H.	1349 L Street.
Bowman, John Alexander	D. C.	61 I Street.
Braman, Charles Edwin	R. I.	1334*a* B Street, S. E.
Brandes, August Rudolph Ferdinand	Cal.	Govt. Printing Office.
Briggs, Victoria J	N. Y.	Rm. 33, The Brunswick.

Name.	Legal residence.	City address.
Brooks, Walter John	Penn.	57 N Street.
Bryson, Laura Elizabeth	Pa	714 12th Street, N. E.
Butler, Barbara Wallace	D. C.	4 B Street, N. E.
Byrne, Henry Herbert	N. Y.	105 Maryland Ave., N. E.
Carpenter, Essex Porter	D. C.	1921 G Street.
Chadwick, George Albert	N. J	623 South Fairfax Street.
Charles, Garfield LL.B., 1904, LL.M., 1905, Georgetown University.	Ill	1203 Q Street.
Church, Grace Ella	D. C.	626 N. C. Avenue.
Condron, Gertrude Cleone	D. C.	816 K Street.
Connelly, Mary B. S., 1891, Columbian University.	D. C.	1438 S Street.
Cook, Richard John	Ark	2024 G Street.
Corpus, Rafael	P. I.	1308 R Street.
Curtis, William Barnard	N. Y.	Chevy Chase. Md.
Daniels, Richard Duvall	D. C.	Brookland, D. C.
Davis, Allan B. S., 1890, M.S., 1896, Columbian University.	Ohio	900 11th Street, S. E.
De Iesi, Pauline Mazurie	Penna.	The Cumberland.
Doing, Jennie E.	Md.	1007 L Street.
Donnally, Mary Louise	D. C.	1018 14th Street.
Dowling, Edwin Joseph	D. C.	523 14th Street, N. E.
Dufour, Arline Hughes	D. C.	1343 L Street.
Duncan, William	Mass.	Hydrographic Office.
Dunlop, William L., Jr.	D. C.	3014 N Street.
Dunwoody, Ellen	D. C.	1522 31st Street.
Duras, Victor Hugo LL.B., 1902, University of Nebraska. LL.M., 1903, Columbian University.	Nebr	2000 F Street.
Dutton, Edwin C. LL.B., 1901, Washington College of Law.	Md.	416 5th Street.
Duvall, Mildred.	D. C.	1827 M Street.
Dye, John Walter	Minn.	1514 K Street.
Finch, Elmer Harrison	Mich.	1923 K Street.
Fisher, Dwight Wilton	D. C.	1828 G Street.
Fisher, Lewis Civille	Colo.	1434 Columbia Road.
Gardner, Raymond Bigelow	Mich.	1303 Clifton Street.
Gillespie, Elizabeth R.	Ky.	1313 N Street.
Gloetzner, Herman Francis	Idaho.	1228 M Street.
Gonzalez, Antonio Cornelius	N. Y.	1417 K Street.
Gordon, Hayner Haskell	Ohio	1310 Princeton Street.
Gow, Bernard Arthur L.L.B., 1896, Missouri State University. LL.M., 1905, The George Washington University.	Mo.	921 8th Street.
Hall, Willis Edgar	Ind.	1330 F Street.

Name.	Legal residence.	City address.
Hance, Emma Osborn	Va.	R.F.D.No.4, Wash., D.C.
Handy, Walter Kerr	Va.	1331 12th Street.
Heimbeck, Adolph James	Iowa	Auditor for Treas. Dept.
M.Dip., 1905, The George Washington University.		
Herriott, Ruth E.	D. C.	1127 Roanoke Street.
Hoberman, Samuel	N. J.	908–12 N. J. Avenue.
Holzberg, Tonnis Julius	D. C.	911 N. H. Avenue.
Hord, Parker Abner	Ky.	607 E Street.
Horsey, Anna Carroll	Md.	1828 Jefferson Place.
Hough, Roland P.	Va.	1106 6th Street.
Jewell, Benson Mundy	Ill.	318 8th Street, N. E.
Johnson, Albert Sutton	D. C.	1316 Vermont Avenue.
Kasugai, Jotaro	Japan	1126 25th Street.
Keller, John Butt	D. C.	1213 Mass. Ave., S.E.
Keneipp, Hugh	Ill.	313 5th Street S. E.
LL.B., 1901, University of Michigan.		
Killough, Isabelle Taliaferro	D. C.	Gunston Hall.
Koetz, Katherine	Penn.	1516 H Street.
Kuhn, Charles	Ohio	1308 I Street.
Locke, John Dexter	N. H.	Normandie.
Lockwood, Vesta Janet	D. C.	21 7th Street, S. E.
Low, Fred Henshaw	D. C.	1730 Conn. Avenue.
McCarthy, Charles Henry	R. I.	2255 L Street.
McKnew, Edna Isabelle	D. C.	1322 Q Street.
McLain, Daniel	S. Dak.	1202 K Street.
MacLeod, Helen Mar	D. C.	1347 Princeton Street.
McManus, Joseph	Mass	1916 Sunderland Place.
LL.B., 1904, LL.M., 1905, Georgetown University.		
Maddren, Alfred Geddes	D. C.	131 A Street, N. E.
Marcy, William Larned	Penn.	233 Florida Avenue.
Mertz, Marjorie Ruth	D. C.	3031 Newark Street.
Miller, Thomas Leo	D. C.	Woodley Apartment.
Moneyway, James Lewis	Ala.	Room 56, Busch Bldg.
Moore, Eglantine Lee	D. C.	1308 Wallach Place.
Moore, Margery Jane	N. D.	1636 30th Street.
Moore, Maurice Malcolm	Mich	1359 Yale Street.
Moore, Thomas Emmett	D. C.	45 Quincy Street.
Morhart, Charles Christian	D. C.	228 Morgan Street.
Moskedal, Lillian Belle	Okla.	508 East Capitol Street.
Mowry, Herbert Hager	Minn.	1319 Kenesaw Avenue.
Mueden, Pauline	D. C.	437 M Street.
Murray, John Donaldson	Md.	1729 H Street.
M.D., 1893, College of Physicians and Surgeons.		
Murray, Josephine Mary	Wis.	945 K Street.
Murray, Sue Harriet	D. C.	1711 35th Street.

Name.	Legal residence.	City address.
Noel, Fabian Peter	Md.	The Geo. Wash. Univ.
Noyes, Clara Bernard	D. C.	1349 Lansing St., Brookland, D. C.
Oberlin, Paca	Va.	1238 5th Street.
LL.B., 1903, LL.M., 1904, Colorado University. M. Dip., 1905, The George Washington University.		
Parkman, Mary Rosetta	D. C.	800 E Street, N. E.
Parris, Worden Whitman	D. C.	3122 P Street.
Pellett, Mirl Edison	Ill.	307 East Capitol Street.
Peltz, Edna May	Ill.	925 New York Ave.
Portner, Oscar Charles	Va.	1410 16th Street.
Powell, Eris	Tenn.	1368 Kenyon St., N. W.
Raymond, Elizabeth Jarvis	Conn.	1444 Rhode Island Ave.
Reich, Mary Grace	D. C.	2902 P Street.
Rhee, Syngman	Korea	802 L Street.
Robertson, Tillie J.	Texas	Brookland, D. C.
Robertson, Willard	Texas	Brookland, D. C.
Sams, Elder E	Iowa	1306 L Street.
Ph.B., 1897, Mississippi Agricultural and Mechanical College.		
Saxton, Howard	Nebr.	103 I Street.
LL.B., 1901, University of Nebraska. LL.M., 1904, Columbian University. M.Dip., 1905, The George Washington University.		
Schofield, Henry Kendrick	Miss.	213 5th Street, N. E.
Scudder, Margaret	D. C.	1126 Lamont Street.
Seitz, Marie Lottie	D. C.	1335 R Street.
Siegel, Benjamin	Md.	213 C Street.
Siggons, Mary Henderson	Penn.	The Rochambeau.
Smith, Lucian Conway	Va.	Alexandria, Va.
Smith, Russel	Oreg.	Normandie Hotel.
Smith, William Winfield	Tenn.	1122 16th Street.
Stocking, Fanny Huldah	D. C.	1323 Princeton Street.
Strobel, Julia Henry	D. C.	16 R Street.
Strong, Grace	Vt.	1539 I Street.
Svensson, J. Alfred	D. C.	2017 G Street.
M.E., 1888, Technical Institute, Stockholm, Sweden.		
Tait, George Lester	D. C.	610 Tennessee Avenue.
Thomas, Clark Stetson	Penn.	1718 13th Street.
M.A.L., 1905, Iowa Christian College.		
Thompson, Helen Seal	Penn.	Forest Glen, Md.
Tocro, Edward Chicksien	China	The Portner.
Tong, Yu-Nin	China	Chinese Legation.
Torney, John Henry	D. C.	1118 I Street, S. E.
Twyeffort, Frank Hubbard	N. Y.	1736 G Street.
Vorkoeper, John	Wis.	1921 G Street.

Name.	Legal residence.	City address.
Wait, C. Bernard	Ind. Ter.	23 1st Street, N. E.
Weidemann, Auguerite Elise	D. C.	1237 Princeton Street.
Whitaker, Gertrude	Ga	Census Bureau.
White, Charles Mason	Va.	1322 L Street.
Young, Francis Hunter	Ill	1457 Chapin Street.

Auditors.

Burnap, Charles Edward	Ill.	2001 Kalorama Avenue.
Dickinson, Bertha	Va.	1743 Q Street.
Kohlrausch, Hermine	Germany	1458 Staughton Street.

WASHINGTON COLLEGE OF ENGINEERING.

Bachelor of Science in Civil Engineering.

Name.	Legal residence.	City address.
Adams, Raymond Edmund B.A., 1891, Central High School, Philadelphia, Penn.	Penn.	2118 G Street.
Appelman, Louis C.	S. Dak.	637 Maryland Ave., N.E.
Ballenger, John Everett	D. C.	941 H Street.
Burchard, Edwin Day	D. C.	1616 3d Street.
Burwell, Eilbeck Mason	N. Y.	1127 4th Street.
Cole, Luke Adolphus	W. Va.	Coast and Geod. Survey.
Conard, Robert A.	D. C.	The Stoddart.
Croxton, Roland Albert	D. C.	1332 T Street.
Curran, William Joseph Francis	Va.	437 S Street.
Curtis, James Eugene	N. Y.	1011 K Street.
Davidson, William Falconer	N. C.	1226 Evarts Street, N. E.
Davis, Raymond Tilton	Md.	509 3d Street.
Davis, Robert Harkness	D. C.	938 O Street.
Dodson, James Dunbar	D. C.	1714 F Street.
Dougherty, Howard Francis	Md	1002 11th Street.
Dwyer, John Rochford	D. C	628 F Street, S. W.
Dyson, Arnold Horton	R. I.	1919 35th Street.
Elliot, William P.	D. C.	The Portner.
Garvin, Edgerton Chester	Ohio	The Brunswick.
Gill, Wilbur Draper	D. C.	1925 Cincinnati Street.
Godwin, Harold Ogier	S. C.	1515 29th Street.
Hartley, Harry Carter	Ill.	2, The Irving.
Hill, Hugh Stewart	Wyo	815 11th Street, N. E.
Hursey, John Stealey	D. C.	1815 Vernon Avenue.
Kemp, Silas V.	Md.	Navy Yard.
King, Edwin Hauptman	D. C.	The Royalton.
Laurie, Johannes Cranston	Penn.	1022 9th Street.
Lawrence, Glenn Rupert	D. C.	3425 P Street.

Name.	Legal residence.	City address.
Linthicum, Frank Harman	D. C.	2116 1st Street.
McInturff, William Carl	Va.	The Milton.
Magruder, Marshall	D. C.	Wis. Ave., Station A.
Meads, Eugene	D. C.	101 4th Street, N. E.
Meyer, Herbert Alton	Ohio	118 R Street, N. E.
Miller, Frank Tremain	Mich.	226 E Street, N. E.
Moody, Theodore L	Md	1512 P Street.
Murphy, Lee O	N. Y.	82 V Street.
Padgett, Harold Dement	Md.	U. S. Geol. Survey.
Panossian, Hagop Avak	S. C.	1834 K Street.
Pfau, James Francis	Minn	The Colonial.
Poole, George	D. C.	903 E Street, S. E.
Reppenhagen, Ernest	N. Y.	9 9th Street, N. E.
Rodgers, William Joyce	D. C.	932 C Street, S. W.
Ross, Erwin Worth	N. C.	1604 K Street.
Ryan, Daniel Aloysius	D. C.	134 M Street, S. W.
B. S., 1905, St. John's College, D. C.		
Senior, Thomas Richard	D. C.	203 M Street.
Smith, Harry Locke	N. H.	313 S Street, N. E.
Smith, Myron Davis	Mass.	128 C Street, N. E.
Smoot, Alden	D. C.	3066 Q Street.
Stivers, Arthur Ducat	Mo.	1412 15th Street.
Stonebraker, Harold English	D. C.	645 Mass. Ave., N. E.
Stuwe, John Daniel	Minn	1017 P Street.
Tompkins, Charles Hook	D. C.	1521 North Capitol St.
Turkenton, William James	D. C.	1513 33d Street.
Wanner, Howard Paul	Penn	Hotel Stratford.
Waters, Joseph Henry	D. C	Takoma Park, D. C.
Weller, Michael Angelo	D. C.	408 Seward Square.
Whiting, Louis Wine	Md.	Hyattsville, Md.
Winter, Maxwell W	Nebr	814 A Street, S. E.
Yates, Robert Raleigh	Va.	1608 6th Street.

Bachelor of Science in Electrical Engineering.

Abert, Franklin Bache	Md	Rockville, Md.
Blanco, Enrique	D. C.	1016 10th Street.
Boyden, John Hanson	Va.	1014 K Street.
Bruninga, John Hermann	Ill.	Navy Yard.
Carty, Roy Franklin	Md.	1234 Howard Street.
Call, Loren Heinlein	D. C.	1448 Howard Avenue.
Daniels, Ara Marcus, Jr	D. C.	1401 T Street.
Daniels, Ralph Edward	Ark	2024 G Street.
Drysdale, James Murray	Colo	Patent Office.
LL.B., 1905, National University.		

Name.	Legal residence.	City address.
Easterday, George Winship	D. C.	1681 31st Street.
Fehr, J. Ralph	Ill.	2231 15th Street.
Fleming, Robert F.	D. C.	1847 Wyoming Avenue.
Gunning, James McIntosh	N. J.	634 East Capitol Street.
Gwinn, Thomas R	Ga.	1216 Connecticut Ave.
Johnson, Arthur Edward	Conn.	1523 Vermont Avenue.
Kemon, Lee B.	D. C	1723 3d Street, N. E.
Kisseleff, Charles William	N. Y.	1030 North Capitol St.
McPike, Martin John	Penn.	812 1st Street.
Magers, James Ellsworth	Ill.	812½ 11th Street, N. E.
Nickel, William Frederick	Md.	382 Patent Office.
Parry, William	Penn.	1919 G Street.
Parsons, John	Ky.	Dept. of Com. and Lab.
Repetti, Joseph S.	D. C.	149 B Street, S. E.
Repetti, William Charles	D. C.	404 Seward Square.
Robinette, Fred. Garfield	D. C.	301 Maryland Ave., N. E.
Rodgers, Nevell Kiepstein	Va.	222 S. Fairfax St., Alex.
Rose, Karl	S. Dak.	58 H Street.
Shepherd, Emil Lawrence	Md.	1338 R Street.
Stabler, Harold Brooke	Md.	The Regina.
Sterrett, John Adlum	D. C.	Pierce Mill Road.
Stillman, Paul Rollins	Iowa.	615 7th Street, N. E.
Swayne, Clyde Chalmers	Penn	3415 Ashley Terrace.
Todd, J. Calhoun Vaughn	Ky.	1941 Vermont Avenue.
Veihmeyer, Frank	D. C.	438 10th Street, S. W.
Ward, Philip Henry, Jr.	D. C.	1756 Penn. Avenue.
Webster, George Gerald	D. C.	5403 7th Street.
Wenderoth, Ernest F.	N. Y.	Bureau of Standards.
Wilson, Richard Hagan	D. C.	2320 I Street.

Bachelor of Science in Mechanical Engineering.

Acker, Kemp Gerard	D. C.	913 16th Street.
Backus, Curtis Beall	Va.	1203 N. H. Avenue
Backus, Willian Alden	Va.	Glencarlin, Va.
Bacon, James Everett	Nebr.	807 18th Street.
Ball, Eugene Maurice	D. C.	3134 P Street.
Bouvier, Emerson Rexford	Penn.	Bureau Steam Engin'g.
Bragaw, Richard	N. Y.	2002 G Street.
Burrell, William Webster	Penn	417 Massachusetts Ave.
Clothier, Albert Lea	Ky.	Int. Revenue Bureau.
Davidson, William Key	D. C.	309 A Street, S. E.
Fryer, Ross Lander	N. Y.	82 S Street.
Fuchs, Henry	Mo.	3234 N Street.
Gary, Howland	Va.	R. F. D. No. 2, Alex., Va.
Gibson, Harry C	Penn	Bureau of Standards.

Name.	Legal residence.	City address.
Hough, Edgar J.	D. C	472 Maryland Ave., S.W.
Jenkins, Oliver Lloyd	Ind	413 A Street, S. E.
Lorando, Stephen Thomas	D. C	1518 31st Street.
Medford, Perry	D. C	1631 3d Street.
Miller, Elton Willard	Cal	1825 1st Street.
Pipes, Walter Logan	D. C	916 T Street.
Rouzer, Horace Dodge	Md	753 8th Street, S. E.
Schaaf, August	Md	2231 15 Street.
Stafford, Charles Francis	N. Y	420 C Street, S. E.
Sutton, Walter Marvin	Va	Ballston, Va.
Watkins, Francis Benjamin	D. C	1626 S Street.

Special.

Evans, Oscar Raymond	D. C	1719 U Street.
Fox, Eugene Valentine	N. Y	421 6th Street.
Freeman, Louis George	D. C	1700 Columbia Road.
Frick, George Frederick	Penn	1838 4th Street.
Garland, Minnie O	Wyo	Dept. of Agriculture.
Hoffman, Edwin	Penn	523 B Street, N. E.
Kern, Walter Everett	D. C	29 R Street.
Mackintosh, Ernest King	D. C	25 Quincy Street.
Moore, Arthur Allston	D. C	427 Monroe St., Anacost.
Sampson, Ralph Earle	D. C	1613 N. H. Avenue.
Shoemaker, William David	N. Y	640 F Street.
Waring, Adrian Duncan	D. C	2518 13th Street.
Warren, Frank Eugene	Md	1218 9th Street.

ARCHITECTURE.

Bachelor of Science in Architecture.

Name.	Legal residence.	City address.
Austin, Hamilton Livingston	Ark	1208 M Street.
Baker, Josephine Rose	Md	Hyattsville, Md.
Fleming, William Henry Irwin	D. C	1847 Wyoming Avenue.
Holmes, Osgood	D. C	1444 Staughton Street.
Illman, Hubert Percy	D. C	1528 10th Street.
Jackson, Henry Edmond	Va	2405 18th Street.
Lombard, Charles Russell	Maine	503 Spruce Street.
Manville, Loren Robert	Iowa	The Gladstone.
Mattox, Gail	Ohio	61 Quincy Street.
Prince, Roy Webster	D. C	742 N. J. Avenue.
Smith, Delos Hamilton	Ariz	1905 F Street.
Sullivan, Francis Paul	D. C	1823 Vernon Avenue.
Urling, Neel W	Penn	1120 13th Street.

Name.	Legal residence.	City address.
Wagner, S. Peter	Md.	1330 13th Street.
Wéber, Gusztáv	Hungary	409 4th Street, N. E.

Special.

Name.	Legal residence.	City address.
Atkinson, Robert Bruce	D. C.	940 French Street.
Bachschmid, Ernst Christian	D. C.	310 B Street, N. E.
Berryman, George Rue	Va.	1311 Q Street.
Blasey, Joseph	D. C.	214 Arthur Place.
Bubb, Ralph Simpson	D. C.	719 9th Street, N. E.
Burnham, Brooke Browning	D. C.	103 C Street, S. E.
Childs, George Singleton	Md.	1825 I Street.
Coleman, Thomas Carlisle	N. Y.	The Westover.
Drane, Estella Constance	D. C.	419 Mass. Avenue.
Dysland, Henry Theodore	Wis.	150 E Street, N. E.
Fitzpatrick, Charles C.	N. Y.	645 8th Street, N. E.
Fowle, Arthur Clayton	D. C.	446 M Street.
Hutchinson, Carleton Waterbury	D. C.	1331 G Street.
Keene, Herbert Newton, Jr.	D. C.	208 Elm Street.
Knowles, William Alexander	Md.	National Museum.
Lockie, Joseph A.	Me.	1601 Laurel Avenue.
McAuley, Hugh Nisbet	D. C.	530 21st Street.
Nichols, Albert Benjamin	Conn.	308 C Street, N. E.
Parker, Claud Eubank	D. C.	1638 R. I. Avenue.
Pierce, Godwin Raymond	Penn.	16 Kentucky Avenue.
Rider, William P.	Md.	1607 7th Street.
Wallace, William G. F.	Fla.	3011 Cambridge Place.

TEACHERS' COURSES.

Aesthetics.

Name.	Legal residence.	City address.
Bogan, Rose M.	D. C.	606 Massachusetts Ave.
Burger, Mary A.	N. Y.	2008 1st Street.
Burke, M. Lillian	D. C.	608 9th Street, N. E.
Clayton, Alice May	D. C.	15 U Street.
Greene, Olive W.	D. C.	12 I Street, N. E.
Hutchinson, Minnie B.	D. C.	306 5th Street, S. E.
Kemp, Bertha	D. C.	1123 13th Street.
Mason, Josephine D.	D. C.	132 A Street, N. E.
Moore, Margery Jane	D. C.	1636 30th Street.
Rupli, Theodosia	D. C.	174 P Street.
Rutherford, Edith	N. Y.	107 Md. Ave., N. E.
Sliney, Rose Standish	D. C.	1428 Welling Place.
Townley, M. B.	N. Y.	Washington College.
Turner, Elsie	D. C.	414 B Street, N. E.
Van Doren, Charlotte A.	D. C.	647 East Capitol Street.

Archaeology, Classical.

Name.	Legal residence.	City address.
Baker, Josephine	Md.	Hyattsville, Md.
Burden, Katherine Mary	D. C.	1309 Riggs Street.
English, Maude Franzoni	D. C.	2012 15th Street.
Flannery, Mary Philomena	D. C.	1600 1st Street, N. E.
Gardiner, Pearl F.	D. C.	717 10th Street.
Hussey, Edmondson	D. C.	13 Randolph Place.
Twichell, Bertha Forbes	Mass.	620 I Street.

Architecture.

Bugbee, Mary Florence	D. C.	101 12th Street, N. E.
Croxton, Grace A.	D. C.	1332 T Street.
Drane, Estella Constance	D. C.	419 Mass. Avenue.
Illman, Hubert Percy	D. C.	1528 10th Street.
Mattox, Gail	Ohio.	61 Quincy Street.
North, Hilda	D. C.	2807 14th Street.
Queen, Margaret	D. C.	113 C Street, S. E.
Reeves, Fannie Lee	D. C.	730 22d Street.
Thönssen, Ruby E	D. C.	315 C Street, S. E.
Tompkins, Lida Roberta	Va.	1881 3d Street.

Diplomacy.

Connolly, Frankanna	D. C.	1628 Swann Street.
Dow, Annie M	Mass.	230 A Street, N. E.
Foster, Mrs. Corra Bacon	Texas.	307, The Plaza.
Graham, Josephine E.	D. C.	209 3d Street, S. E.
Lowry, Mamie	D. C.	1934 3d Street.
Nichols, Helen G.	D. C.	2821 11th Street.
Otterback, Sarah E.	D. C.	318 E Street, N. E.
Sexton, Teresa L.	D. C.	1227 F Street, N. E.
Willcox, Grace	Md.	2030 P Street.
Wright, Olive	D. C.	The Olympia, 63.
Yoder, Bertha A.	D. C.	124 11th Street, S. E.

Economics.

Given, M. E	D. C.	1761 U Street.
Hoyme, Eleanor Bruce	D. C.	731 13th Street.
Malone, Marion Josephine	D. C.	414 Albany Street, N. E.
Shanley, Rebecca E.	D. C.	Business High School.
Young, Irene Ottilie	D. C.	904 New York Avenue.

English.

Clancy, M. Agnes	D. C.	1519 Rhode Island Ave.
Fant, Jessie Du Bois	D. C.	321 A Street, S. E.

Name.	Legal residence.	City address.
Fitz Gerald, Louise	D. C.	1804 S Street.
Haslup, Alice Elma	Md	1322 I Street.
Heath, Louise	D. C.	617 Florida Avenue.
Howell, Blanche Braxton	D. C.	724 10th Street, N. E.
McLean, N. E. L	D. C.	1331 Q Street.
Maloney, Emma J.	D. C.	Cameron Flats.
Marshall, E. Blanche	D. C.	635 East Capitol Street.
Meyers, Minnie Matilda	D. C.	1319 Kenesaw Avenue.
Smith, Janie Alice	D. C.	637 Mass. Ave., N. E.
Tennyson, James Anna	Md	224 8th Street, S. W.
Underwood, Harriet	N. Y.	3223 N Street.
Van Doren, Emma May	D. C.	629 Mass. Ave., N. E.
Vansant, Elsie	D. C.	209 11th Street, S. W.
Walker, Alberta	D. C.	The Landmore.
Wagner, Maud	D. C.	12 9th Street, S. E.
Wanstall, Laskey	D. C.	1706 F Street.

History.

Blandford, Nannie	D. C.	801 C Street, S. W.
Beller, Lizzie C	D. C.	235 1st Street, N. E.
Clark, Anna J	D. C.	2907 13th Street.
Connell, Lillie M	D. C.	610 N. J. Avenue.
Ditto, Janet Lyle	D. C.	The Mendota.
Galiher, Blanche P	D. C.	436 6th Street, N. E.
Gibbs, Kate Maria	Mass.	1216 S Street.
Hardy, Rose Lees	D. C.	638 East Capitol Street.
Heath, Louise	D. C.	617 Florida Avenue.
Holmes, Grace Bruce	D. C.	Takoma Park, D. C.
Hughes, Margaret L	D. C.	315 B Street, N. E.
Hummer, Elizabeth Alice	D. C.	638 East Capitol Street.
King, Winifred	D. C.	1347 S Street.
Lanman, Lula E	D. C.	2209 M Street.
Michaelsen, Elsie	D. C.	1424 W Street.
Shanley, Rebecca E	Penn	117 4th Street, S. E.
Smith, Emma Miriam	Penn	800 E Street, N. E.

Law, Constitutional.

Austin, Miriam J	D. C.	728 F Street, N. E.
Brosnahan, Margaret Loretto	D. C.	916 1st Street.
Daly, Ida M	D. C.	Lanier Heights.
Duffy, Helen Augusta	D. C	222 K Street.
Nichols, Helen Gilman	D. C.	2821 11th Street.
Potter, Mary V	D. C.	903 R Sireet.

Name.	Legal residence.	City address.
Roach, Florence M.	D. C.	1826 North Capitol St.
Sisson, Abbie Mills	D. C.	1804 1st Street.
Walker, Mrs. Mary E. C.	D. C.	1125 11th Street.
Yoder, Bertha Alice	D. C.	124 11th Street, S. E.

Summary.

Graduate Studies:		
Candidates for the M.A. degree	12	
Candidates for the M.S. degree	12	
Candidates for the C.E. degree	2	
Condidates for the E E. degree	2	
Candidate for the M.E. degree	1	
Candidates for the Ph.D. degree	48	
In attendance	5	
		82
Columbian College:		
Candidates for the B.A. degree	92	
Candidates for the B.S. degree	57	
Candidates for the B.S. in Chemistry degree	17	
Candidate for the B.S. in Politics degree	1	
Special	133	
Auditors	3	
		303
Washington College of Engineering:		
Candidates for the B.S. in C.E. degree	59	
Candidates for the B.S. in E.E. degree	38	
Candidates for the B.S. in M.E. degree	25	
Special	13	
		135
Architecture:		
Candidates for the B.S. in Architecture degree	15	
Special	22	
		37
Teachers' Courses:		
Æsthetics	15	
Archæology	7	
Architecture	10	
Diplomacy	11	
Economics	5	
English	18	
History	17	
Law, Constitutional	10	
		93
Total		650

DEPARTMENT OF MEDICINE.

FACULTY OF MEDICINE.

Doctor of Medicine.

First Year.

Name.	Legal residence.	City address.
Abbott, John Woodward	Maine	1321 Corcoran Street.
A.B., 1905, Bates College.		
Asbell, Mellege Shaw	S. C.	1320 12th Street.
B.A., 1901, Wafford College.		
Bales, Ernest Norment	Cal.	913 F Street.
Bradley, Henry Moffatt	S. C.	1007 Mass. Ave., N. E.
Brooks, James Joseph Lester	Penn	465 Florida Avenue.
Brown, Jay	Md.	Sibley Hospital.
Chappell, Sidney Lovett	D. C.	Tennallytown.
Chartters, George Chancellor	Va	911 Mass. Avenue.
Clark, Albert Patton	D. C.	1747 U Street.
Phar. D., 1905, National College of Pharmacy.		
Collins, James Cleveland	Va.	1142 6th Street.
Conklin, Rush West	Kans.	Gov't Printing Office.
Craft, Clarence Christian	S. C.	242 North Capitol St.
Docekal, Jan Weastimil	D. C.	U. S. Nat'l Museum.
Dunn, Abner Beebe	Penn	1130 11th Street.
Eldridge, Watson William, Jr.	Md	Kensington, Md.
Everhart, Alpha Ray	Iowa	1820 9th Street.
Fair, Charles Hardy	Va.	1016 13th Street.
Fearing, Henry Martin	N. C.	1016 13th Street.
French, Sanford Williams	N. Y.	Naval Hospital.
Frey, John Paul	D. C.	1224 30th Street.
Gibson, John Latimon	N. C.	1405 New York Avenue.
Gochenour, David Thomas	Va.	28 R Street.
Guasp, Ignacio	P. R.	1719 9th Street.
Gusberg, Morris B.	N. J.	The Geo. Wash. Univ.
Haley, William Marshall	Tenn.	1132 12th Street.
Harrell, Rufus Jesse	Texas	Y. M. C. A.
Harris, Charles McIlvaine	Penn	1816 H Street.
Hekimian, Nejib Nersess	Conn	13th and G Streets.
Ingersoll, Edwin H.	D. C.	3519 Prospect Avenue.
Jobson, William Russell	Penn.	Y. M. C. A.
Kavanagh, James Edward	Mass.	1431 Q Street.
Keneipp, Edgar Percy	Ill.	136 D Street, S. E.
Kerby, James Philip	D. C.	2606 L Street.
McEnery, Douglas Wiltz	La.	1213 K Street.
B.A., 1903, Tulane University.		
McKnight, Frederick W	Ohio	9 Grant Place.

Name	Legal residence.	City address.
McLaughlin, James Alexis	Colo.	1221 K Street.
McLaughlin, William Frank	Penn	717 East Capitol Street.
Macoughtry, James Francis	W. Va.	1017 14th Street.
Mann, Edward Leonard	N. C.	43 Randolph Place.
Mann, Victor Llewellyn	Mich.	1531 8th Street.
Micheloni, Louis Antony	Uruguay.	601 Howard Avenue.
Morris, Horace	Ky.	1411 Corcoran Street.
Morrissey, William Thomas B.A., 1905, Holy Cross College.	Conn.	1509 17th Street.
Nelson, Cyrus William B.S. in Chem., 1903, Oklahoma Agricultural and Mechanical College.	O. T.	Bureau of Chemistry.
Nichol, James Wallace	Mich.	506 8th Street, N. E.
Orrison, Lloyd Foster	Va.	17 Mt. Vernon Place.
Peirce, Robert Philip	D. C.	2900 P Street.
Pole, Samuel Boyce, Jr	D. C.	216 8th Street, N. E.
Powell, Robert Llewellyn	Va.	934 O Street.
Price, Walter	D. C.	438 N. J. Avenue, S. E.
Rougeon, Charles F	La.	1005 G Street.
Sharp, George Tarplit	D. C.	Cleveland Park.
Simonton, Laurence Joseph	Ind	Agric. Dep't, B. A. I.
Sinclair, Leith Llewellyn	Va.	327 M Street.
Sisco, Henry Nathaniel B.A., 1898, Battle Creek College.	D. C.	2 Iowa Circle.
Sorensen, Antone Christian	Utah	1132 12th Street.
Sorrell, Clarence Holden	D. C.	244 8th Street, S. E.
Vasenius, Frederick Walter	Finland.	Takoma Park.
Warriner, William Royall	Va.	1016 15th Street.
Weiler, George Leo	Utah	1132 M Street.
Willis, John Mitchell	W. Va.	1110 New York Avenue.
Wood, Will Pleasant	Ohio.	431 10th Street.

Second Year.

Athey, Thomas Franklin LL.B., 1901, Georgetown University.	Mo.	3107 Wisconsin Avenue.
Avery, Frederick Scott	Mich.	1460 Corcoran Street.
Barsamian, Andraig Markar B.A., 1890, Anatolia College.	N. Y.	806 10th Street.
Brown, Frank J	Iowa.	"Augusta."
Browning, Andrew Johnson	Md.	1322 L Street.
Bryan, William Alvin	Iowa	203 6th Street, N. E.
Castell, Louis Bernard Phar. D., 1903, National College of Pharmacy.	D. C.	Soldiers' Home.
Dunmire, Roy Franklin	Penn	1001 B Street, N. E.
Estes, Robert Montgomery	Ky.	1347 L Street.

Name.	Legal residence.	City address.
Everett, Clarence Vivian	Md	War Department.
Everett, Ernest D. A.B., 1899, Baker University.	Mo	23 Q Street, N. E.
Forrer, Herbert Stratford	Ill	630 F Street, N. E.
Frazier, Frank Eugene	Wis	1236 11th Street.
Garnett, Algernon Sydney	Va.	1021 Vermont Avenue.
Gehringer, George M.	Penn	1121 15th Street.
Gonzalez, Antonio C., Jr.	N. Y.	1417 K Street.
Griffith, Thomas Everett	Penn	718 4th Street, S. E.
Hanback, Irven Leonard	D. C.	44 N. Y. Ave., N. E.
Hart, George H. V.M.D., 1903, University of Pennsylvania.	Penn	2317 1st Street.
Higgins, Daniel W., Jr.	Md	130 11th Street, N. E.
Horgan, Edmund Joseph	D. C.	733 13th Street.
Johannes, Dana Berry	D. C.	Takoma Park.
Lawrence, Charles Solomon	N. C.	Columbia Hospital.
Littlefield, John Ramsay	D. C.	Emergency Hospital.
McIver, Evander McNair Ph.B., 1904, University of North Carolina.	N. C.	310 C Street.
MacKnight, Robert Stanley	Mich	2615 13th Street.
Mata, Carlos	Costa R.	16 3d Street, S. E.
Maxwell, Maurice Hopkins	Md	Sibley Hospital.
Molzahn, Herman E.	Minn	812 11th Street.
More, Frederick Clinton	Penn	815 15th Street.
Neate, John Sweyn	D. C.	3009 Dumbarton Ave.
Noyes, Edward Rogers	D. C.	1014 S. C. Ave., S. E.
Ong, Harry Alfred	Ohio	917 S Street.
Patterson, Orra Edgar	Ill	Treasury Department.
Powell, Charles Elcon	D. C.	509 Spruce Street.
Pyne, Herbert Samuel	Utah	1132 12th Street.
Quick, Ralph Andre	Va.	428 H Street.
Rock, George Roscoe	N. J.	The Coywood.
Rozzelle, Keith Kistler	N. C.	207 8th Street, N. E.
Shacklette, William Sidney	Va.	U. S. Naval Hospital.
Sherwood, John Wesley	Md	136 11th Street, N. E.
Simons, Harry Emmerich	D. C.	252 A Street, S. E.
Smith, Ernest Wellington	W. Va.	1825 F Street.
Smith, William Marion A.B., 1901, A. M., 1901, Georgetown College, Kentucky.	Ky	1111 17th Street.
Stilson, Joseph R.	D. C.	126 C Street, S. E.
Tallmadge, Henry Hobart	Penn	1356 Kenesaw Avenue
Tayloe, Harry Marbury	Va.	1121 17th Street.
Taylor, Edward B.S., 1903, in Pharmacy, Alabama Polytechnic Institute.	Ala.	1013 P Street.
Tewksbury, William Davis	Colo	16 3d Street, S. E.

Name.	Legal residence.	City address.
Thompson, Lewis Royer.............	Penn...	801 New Jersey Avenue.
B.A., 1900, Ursinus College.		
Turnbull, Samuel.....................	Fla.	905 10th Street.
Walsh, Patrick Henry	Conn. ..	914 23d Street.
Weber, Frederick C..................	Ohio....	121 Md. Ave., N. E.
Weidemann, Clarence Conrad........	D. C....	1237 Princeton Street.
Wheatley, Charles.....................	Md.....	Geo. Wash. Hospital.
Wheeler, Arthur Joseph..............	Ill..	1923 K Street.
Wilhelm, Joseph	Ill.	1111 17th Street.
Willis, Harry Clay....................	N. C....	932 K Street.
Wolfe, James Thruston..............	Va.	2022 G Street.
Wolfe, Rowland Daniel..............	Md	1335 H Street.

Third Year.

Name.	Legal residence.	City address.
Armstrong, Arthur Durham	Ontario.	10 3d Street, N. E.
Barnesby, Walter Raleigh	Ill.	The Brunswick.
Barry, Joseph Francis................	N. Y....	1012 13th Street.
Beale, Kenneth Foster...............	Md	Branchville, Md.
Biggs, Joseph Rozier	D. C....	1930 8th Street.
Bogan, Joseph Borrows..............	D. C....	606 Mass. Avenue.
Bower, Charles Franklin	S. Dak..	734 12th Street.
Boyd, William Alexander............	N. C....	The Fredonia.
Bryson, Herbert James..............	Penn...	714 12th Street, N. E.
B.A., 1903, The George Washington University.		
Burket, Clare William................	Penn...	1519 Kingman Place.
Carr, William Brown, Jr.............	Va.	1418 L Street.
Carter, Paul Irving....................	Cal.....	1418 L Street.
Chapman, John Madison.............	Md.....	Department of Justice.
Chipman, Cline N................. ..	Ky....	1215 I Street.
Cliff, Benjamin F......................	N. C....	1300 Mass. Avenue.
Conklin, Coursen Baxter	N. Y...	1611 13th Street.
Coster, Leonard Martin...............	D. C....	403 2d Street, S. E.
Darnall, Moses Hubbard.............	Texas..	1618 15th Street.
Davis, Ezra McKnight	S. C....	937 K Street.
Dewey, Christian Henry..............	Ill......	32 Seaton Street.
M. Accts., 1899, Western Normal College, Shenandoah, Iowa.		
Emery, James Armitage.............	Md.....	Rm. 60, The Olympia.
Garton, Alfred Clark.................	Ind	1902 H Street.
Grant Charles Vincent.......... ...	Penn. ..	The Coywood.
Grant, John Lee......................	Va.	1313 H Street.
Habel, William Parker Herbst..... ..	Penn. ..	618 22d Street.
Phar. D., 1903, National College of Pharmacy.		
Hart, John White.....................	Mass. ..	949 S Street.
B.A., 1896, Boston College.		

Name.	Legal residence.	City address.
Hastings, John Emery	N. Y.	Census Bureau.
Haywood, John K.	N. Y.	1210 T Street.
B.S., 1896, Cornell University.		
Hoberman, Samuel	N. J.	908 12th Street.
Holmes, Robert Ward	N. H.	1403 12th Street.
Howlett, Howard Henry	La.	1313 Wallach Place.
Janney, James Garfield	Mo.	U. S. Naval Hospital.
Johnston, Henry Vernon	D. C.	University Hospital.
Kearney, Henry Walper	Va.	1013 M Street.
Kline, Lane Bruce	Va.	519 Mass. Avenue.
Lamkin, Joseph Bayard	Ga.	216 New York Avenue.
Lee, Thomas Alexander	D. C.	1755 Church Street.
Levy, William Victor	N. J.	8 B Street, N. E.
McKee, Charles Bradford	Cal.	Y. M. C. A. Building.
McLean, Frank	D. C.	735 13th Street.
Mess, William Adam	Ind.	Garfield Mem. Hospital.
Phar., D. 1903, National College of Pharmacy.		
Meyer, Henry Adolph	Penn.	212 8th Street, S. E.
Moffitt, H. Watson	Ohio.	127 B Street, S. E.
Monk, Frederick Hinton	N. Y.	1335 F Street.
Morris, Roy Thomas	D. C.	1209 O Street.
Moser, William Calvert	Penn.	Soldiers' Home.
Neilson, Alexander, Jr.	Utah	512 B Street, N. E.
Rector, Frank Leslie	Okla.	925 12th Street.
B.S., 1902, Agricultural and Mechanical College of Oklahoma.		
Schapiro, Louis	Wis.	1016 13th Street.
Sims, William C.	La.	1029 Dartmouth Street.
Stephenson, Eugene	Texas.	1382 E Street, N. E.
Stout, Henry	D. C.	United States Jail.
Smith, J. Allen	N. Dak.	1931 K Street.
Smith, Thomas Francis	Fla.	The Grand.
Stetson, Thomas	D. C.	Nat'l Safe Dep., Savings and Trust Co.
Sullivan, Edward Francis	Conn.	1019 10th Street.
Tastet, David Walker	D. C.	76 Seaton Street.
Terry, Philip Roy	La.	1437 Kenesaw Avenue.
Thomas, William Joshua Groat	D. C.	905 O Street.
Titus, Stanley Herbert	D. C.	Coywood Flat.
Tomlin, Timothy Harrington	Mo.	1009 B Street, N. E.
Van Vliet, Frederick C., Jr.	N. J.	2002 G Street.
Waldecker, Franz Carl	Kansas.	The Augusta.
Wallace, Clifton Robert	Va.	1016 13th Street.
Waring, John Brockenbrough H.	Va.	1830 Oregon Avenue.
Warner, Harry J.	Ill.	1105 13th Street.
B. S., 1901, University of Illinois.		

Name.	Legal residence.	City address.
Warner, Willis Henry	Mich.	1536 Kingman Street.
Watson, Charles Lyman	D. C.	1300 Mass. Avenue.
Weithas, Richard C.	N. Y.	General Land Office.
Whamond, Frederick Gordon	Ill.	1234 Duncan Street.
White, Eben Wesley	N. Y.	1236 11th Street.
Willets, David Gifford	N. J.	1320 I Street.
Ph.B., 1902, Wesleyan University.		
Williams, Richard Theodore	D. C.	1319 8th Street.
Wilson, Edward Comstock	N. Y	U. S. Patent Office.
Yates, Robert Jackson	Va.	1300 Pennsylvania Ave.

Fourth Year.

Ammerman, Charles Clark	N. Y.	911 N. C. Ave., S. E.
Arntzen, Julius Leo	Mo.	1404 L Street.
Battles, Samuel Lee	La.	701 7th Street.
Bennett, Robert Anderson	Md.	832 13th Street.
Brecht, Nelson Duvall	D. C.	609 22d Street.
Brown, Ernest William	Conn.	1310 Princeton Street.
Ph.B., 1897, Ph.D., 1900, Yale University.		
Burnell, William Barry	Oregon.	1519 Kingman Place.
Carswell, Fountain Lee	Ga.	1832 Baltimore Street.
Clements, Lyman Jairus	Miss.	123 6th St., N. E.
Clifford, John Sullivan	N. H.	812 12th Street.
Compton, Arthur George	D. C.	1121 Roanoke Street.
Currie, James Daniel	Texas.	1229 New York Ave.
Cuthbertson, Charles Wesley	D. C.	309 7th Street.
D.D.S., 1900, Columbian University.		
Davis, Alfred Preston	N. C.	1301 H Street.
M.D., 1894, Kentucky School of Medicine.		
Dollman, Clarence Mazurine	Va.	1000 N Street.
Edmunds, Meade Randolph	Miss.	1217 K Street.
Forsythe, James Stue	Miss.	1119 6th Street.
Garrison, Philip Eugene	N. J.	107 K Street.
A.B., 1900, Wesleyan University.		
Goss, Ralph Montgomery	Ga.	1902 H Street.
A.B., 1901, University of Georgia.		
Gow, James Robertson	Ohio.	122 D Street, N. E.
LL.B., 1894, Georgetown University.		
Grayson, Charles Shober	N. C.	1404 L Street.
Haggerty, James Edwards	N. Y.	1543½ 3d Street.
Hailman, Hubert Victor	D. C.	301 C Street.
Hamilton, Kosciusko	Tenn.	1203 11th Street.
Hankemeyer, Nathaniel William	Mass.	1018 14th Street.
B.A., 1885, Iowa Wesleyan University.		
B. D., 1890, Chicago Theological Seminary.		

Name.	Legal residence.	City address.
Hardesty, William Slaughter	W. Va.	16 4th Street, S. E.
Harrison, Charles A.	Ill.	1335 H Street.
Hartley, Clarence A.	Ind.	919 New York Avenue.
Heflebower, Roy Cleveland	D. C.	915 N. H. Avenue.
High, Daniel Lee	Md.	416 M Street.
Hill, Paul Stanley	Maine	The Sherman.
B.A., 1901, Bowdoin College.		
Hooe, Robert Arthur, Jr.	Va.	1110 New York Ave.
Huber, Levi Houston	Penn.	906 I Street.
Humphries, John William	Va.	318 3d Street.
Jorgenson, H. Christian	N. Y.	1404 L Street.
Ph.G., 1898, New York College of Pharmacy, Columbia University.		
Kebler, Lyman Frederic	Penn.	1322 Whitney Ave.
M.S., 1892, University of Michigan.		
Lanza, Anthony Joseph	N. Y.	1232 13th Street.
Laughlin, John Royer	Penn.	1460 Corcoran Street.
Lund, Herbert Z.	Utah	107 2d Street, N. E.
McAfee, Larry Benjamin	Ind.	House of Reps.
McConnell, James Henry	N. Y.	905 Florida Avenue.
Mebane, William Nelson	N. C.	1217 K Street.
Middleton, Carroll Sewall	Md.	1404 L Street.
Montgomery, Herbert Bridger	Ohio	1828 N. Capitol St.
Moore, Mead	Ky.	The Brunswick.
Murdoch, Lester Hughes	Texas	1713 4th Street.
Murphy, Timothy Francis	Maine	The Sherman.
Nutting, Hugh	N. Y.	1460 Corcoran Street.
Phillips, Orlyn Sargent	Neb.	1215 12th Street.
Reeves, Arthur F.	N. C.	De Soto.
Repetti, Fred	D. C.	527 6th Street, S. E.
Phar. D., 1901, National College of Pharmacy.		
Ryan, Bernard St. Elmo	Va.	1301 Corcoran Street.
Sheep, William Lloyd	N. C.	1300 Massachusetts Ave.
Simpson, Charles Augustus	Va.	Wash. Asylum Hosp.
Smith, Stephen Harrison	Va.	Alexandria, Va.
Smith, William Hamilton, Jr	D. C.	1314 Connecticut Ave.
Spire, Richard Lee	N. Y.	1353 F Street, N. E.
Stanley, Arthur Camp	Wis.	2330 Mass. Avenue.
Sterne, Charles Fague	D. C.	1823 Riggs Place.
Stevenson, Earle Clement	Neb.	1404 L Street.
B.S., 1899, Nebraska Wesleyan University.		
M.A., 1903, University of Nebraska.		
Sutton, Dallas Gilchrist	D. C.	921 19th Street.
Swain, Benjamin Hallowell	N. C.	1307 R Street.

Name.	Legal residence.	City address.
Tasker, Arthur Newman	D. C.	Children's Hospital.
A.B., 1902, Wesleyan University.		
Trent, Joseph Peterfield	Va.	1214 I Street.
Van Casteel, Gerald	Penn.	320 Bond Building.
LL.B., 1899, LL.M., 1900, Georgetown University.		
Watson, John William	D. C.	Anacostia.
Wilcox, Horace Leroy	Penn.	2610 University Place.
Woods, Carl Warren	Vt.	1211 13th Street.

Special.

Holden, Fred A.	Mo.	Treasury Department.
B.A., 1900, Dixon College and Institute, Illinois.		
Murray, John Donaldson	Md.	1729 H Street.
M.D., 1893, College of Physicians and Surgeons.		
Washington, Richard	N. Y.	1115 I Street.
M.D., 1894, Columbian University.		

Review.

Browne, Rhodric Winfield	Mass.	908 S Street.
M.D., 1905, The George Washington University.		
Bush, Daniel P.	Neb.	1316 11th Street.
M.D., 1905, The George Washington University.		
Didier, Frederick William	N. C.	302 H Street.
M.D., 1904, The George Washington University.		
Fisher, Raymond Adams	D. C.	595 B Street, N. E.
M.D., 1905, The George Washington University.		
Foster, Romulus Adams	D. C.	2207 Mass. Avenue.
M.D., 1874, The Columbian University.		
French, William Joseph	Minn.	1133 24th Street.
M.D., 1905, The George Washington University.		
Hovsepian, Armen	N. Y.	806 10th Street.
M.D., 1905, The George Washington University.		
Kuehn, Frederick W.	Ind.	1129 5th Street.
M.D., 1905, The George Washington University.		
Pfender, Charles Alexander	Texas.	1013 M Street.
M.D., 1905, The George Washington University.		
Sawyer, Edward Whitmore	Mass.	20 Grant Place.
M.D., 1905, The George Washington University.		
Smith, Lucian Conway	Va.	Alexandria, Va.
M.D., 1905., The George Washington University.		
Stiles, George Whitfield	Okla.	25½ Bates Street
M.D., 1905, The George Washington University.		
B.S., 1900, Oklahoma Agricultural and Mechanical College		

Summary.

CANDIDATES FOR THE M.D. DEGREE:

First year	62	
Second year	60	
Third year	75	
Fourth year	68	
		265
Special		3
Review		12
Total		280

FACULTY OF DENTISTRY.

Doctor of Dental Surgery.

First Year.

Name.	Legal residence.	City address.
Addison, William Richard	Wis	Brookland, D. C.
Angelo, Guy Wilson	Va	1236 13th Street.
Bakshian, Artakey Hagop	Turkey	614 12th Street.
Bernhard, James Walter	Penn	422 2d Street.
Birckhead, Fred Courtney	D. C.	300 C Street, N. E.
Boarman, Alan Smith	Md	Treasury Department.
Britton, Emlyn J	Penn	Washington Barracks.
Cummings, Alfred William	Kans	302 Indiana Avenue.
Deardoff, Edward Everett	Ill	22 R. I. Avenue, N. E.
Gaines, William Embre	Va	1318 I Street.
Gash, Arthur Wellesley	R. I.	517 6th Street.
Grubbs, John A	Va	
Helmig, Casper Florian	Mo	Gov't Printing Office.
Higgins, Charles Millington	W. Va	301 D Street.
Hildreth, Walter Henry	N. Y.	1333 L Street.
Houghtelin, William Clarence	Kans	114 S Street.
Johnson, Harry Dow	Mo	Takoma Park.
Murdoch, Herbert Spencer	Mo	465 H Street.
Pearsall, George Richard	Mass	1804 M Street.
Peck, George Francis	N. J.	1762 U Street.
Polini, Manuel	Costa R.	1918 I Street.
Ramirez-Torres, Manuel	P. R.	1235 6th Street.
Young, Henry Cissel	Md	932 K Street.

Second Year.

Name.	Legal residence.	City address.
Allen, Clyde William	S. D.	1000 M Street.
Bell, Joseph M	Ohio	

Name.	Legal residence.	City address.
Detmer, Charles Edwin	Mont	P. O. Department.
Eskin, Jacob Sidney	D. C.	945 Md. Avenue, S. W.
Jackson, George Percival	N. Y.	641 East Capitol St.
Lawrence, William Francis	N. Y.	30 Randolph Street.
Macdonald, George Bertram Roper	D. C.	612 Erie Street.
Martin, Francisco Jose	Costa R.	573 6th Street.
Merritt, William Allison	D. C.	203 8th Street, N. E.
Pflug, Charles S.	Utah	1110 16th Street.
Phillips, John Albert	Neb.	1215 12th Street.
Shea, James Edward	N. Y	
Shoemaker, Charles Gardner	D. C.	3116 P Street.
Truett, Robert Finley	Ky	2523 University Place.
Vivian, John Taylor	Penn.	1203 East Capitol Street.
Wood, James Frank	Mich	30 Randolph Place.

Third Year.

Ake, Adolphus Blair	Penn	809 N. J. Avenue.
Brittin, Roy Clay	Tenn	P. O. Dep't.
Carroll, Walton C.	Md	College Park, Md.
Chapman, Nathaniel	D. C.	1236 11th Street.
Clinton, Ralph Stuart	N. Y.	General Land Office.
Correll, Ralph S.	Ohio	1215 K Street.
Davidson, Albert Sidney	Va	120 4th Street, S. E.
Handy, Joseph William	Mo	68½ Bates Street.
Harrison, Marion Edwyn	Ga	1106 L Street.
Howser, Upton	Md	1506 6th Street.
Humeston, C. Andrew	Conn	620 I Street.
Murphy, Don Francis	D. C	2447 18th Street.
Murray, Fred Grant	D. C.	209 G Street, N. E.
Neely, Frank Elton	Ind	216½ Q Street.
O'Brien, William Patrick	Conn	119 G Street.
Potter, Vergne W.	Wis	1723 Penn. Avenue.
Prendergast, James Thomas	W. Va.	616 3d Street.
Taylor, John Winslow	Md	112 4th Street, N. E.
Vandewall, Ralph Ivey	Wis	1235 New York Avenue.
Waldo, George Selden D.D.S., 1902, Georgetown University	W. Va.	310 East Capitol Street.
Woodruff, William Henry	N. Y.	1235 New York Avenue.

Special.

Butler, William Earle D.D.S., 1905, The George Washington University.	W. Va.	1723 G Street.
Cole, Seth Eugene D.D.S., 1905, The George Washington University.	Vt.	700 H Street, N. E.
Maphis, Frederick De Witt D.D.S., 1905, The George Washington University.	Va.	1012 12th Street.

Summary.

CANDIDATES FOR THE D.D.S. DEGREE:

First year	23	
Second year	16	
Third year	21	
		60
Special		3
Total		63

DEPARTMENT OF LAW AND JURISPRUDENCE.

Bachelor of Laws.

First Year.

Name.	Legal residence.	City address
Adams, George Royal	Mass.	1211 13th Street.
Allen, Charles Louis	S. Dak.	Light House Board.
Allen, Walter Ellwood	Md.	Navy Department.
Ambrose, George Lewis	Mont.	716 20th Street.
Arlitt, John Louis	Texas.	2026 G Street.
Arundell, Charles Roger	D. C.	1636 R Street.
Atwell, Howard Johnson	Va.	711 A Street, N. E.
Bailey, Fred John B.S., 1901, Middlebury.	Vt.	Buckingham Hotel.
Banning, Archibald Tanner, Jr. B.A., 1904, Cornell University.	N. Y.	925 New York Avenue.
Barndollar, Burton Hack	Penn.	3510 N. H. Avenue.
Barr, James	Wis.	1760 Q Street.
Beall, John Christopher Wagneer	D. C.	1016 E. Capitol Street.
Beard, Burr Archibald	Iowa.	1122 Vermont Avenue.
Beazley, James Henry	Va.	618 M Street, S. W.
Bell, Colley Wood	D. C.	1731 T Street.
Bell, George Arthur B.S.A., 1904, Cornell University.	N. Y.	1212 Q Street.
Berger, Bertram Philip	N. Y.	2319 Penna. Avenue.
Betts, Frank Marshall	Ark.	2120 G Street.
Biddle, Milton Scott	W. Va.	1013 20th Street.
Binsted, John Henry	D. C.	Conduit Road, D. C.
Biscoe, John Edward Grad. in Engl., 1904, Virginia Military Institute.	D. C.	813 21st Street.
Blake, Emmons Reed B.A., 1904, University of Wisconsin.	Ill.	1719 G Street.
Block, Karl Morgan	D. C.	145 11th Street, N. E.
Boesch, Harry Luther	D. C.	616 E Street, N. E.

Name.	Legal residence.	City address.
Bowen, Frank Hunter	Mass	Dept. of Com. & Labor.
Bramhall, Thomas William	N. Y.	42 Randolph Street.
Brandenburg, Edgar Thomas	Penn	915 French Street.
Brooks, Stanley Curtis	Ind	1717 T Street.
Bruninga, John Herman	Ill	Patent Office.
Campbell, Paul	Tenn	229 N. Capitol Street.
Carr, Ira J.	Mich	217a P Street.
Carrington, Edmund	D. C.	Mt. Vernon Flats
Christensen, Andrew	Utah	1227 13th Street.
Church, Melville Durant	D. C.	1608 20th Street.
Cooke, H. Clay	Texas	Y. M. C. A.
Corbett, Edwin Perry	D. C.	929 10th Street.
Couden, Fayette Dickinson	Mass	1310 Columbia Road.
Coulon, Eugene Enet	La	1318 Whitney Avenue.
Crane, William Lucius	D. C.	208 T Street.
Cunningham, Boyd Crum	D. C.	133 C Street, N. E.
Curtis, William Barnard	N. Y.	Chevy Chase, Md.
Cutler, Harold Bert	Iowa	1633 Kenesaw Avenue.
Dane, Walter Alden B.A., 1903, University of Vermont.	Vt	The Lenox, L Street.
Davenport, Lewis Howard	N. Y.	2624 University Place.
Davidson, Arthur William A.B., 1890, Western Reserve University.	Ohio	28 Grant Place.
Davis, Horace Webber B.S., 1905, Washington and Jefferson.	Penn	1907 H Street.
Davison, Ferdinand Donald	Va	1440 Bacon Street.
Day, Rufus Spalding	Ohio	1301 Clifton Street.
Ellis, Leonidas Wilson	Ala	1008 I Street.
Elson, Ernest Benjamin	Neb	903 13th Street.
Espinora, Gregorii E.	Phil. Is.	War Department.
Fleharty, Ward William	Ill	318 East Capitol Street.
Forbes, Harvey Dwight	N. Y.	1362 Irving Street.
Fraser, James Sword	D. C.	Takoma Heights.
Fravel, F. Russell	Va	901 24th Street.
Gable, Charles Lewis	Penn	807 H Street.
Gillam, De Witt Power	N. Y.	Cleveland Park, D. C.
Glaze, Albert Alonzo	Minn	1310 9th Street.
Gonzalez, Antonio C., Jr.	N. Y.	1417 K Street.
Gower, William Jackson	Miss	1335 Vermont Avenue.
Graves, Barak Thomas	D. C.	1406 P Street.
Gray, James Oliver Baynham	D. C.	203 9th Street, S. W.
Green, Burton Richard	D. C.	1259 Kenesaw Avenue.
Guy, Walter Bohrer Ph.B., 1905, Lafayette College.	D. C.	308 5th Street, S. E.

Name.	Legal residence.	City address
Haines, Milton.. B.S., O. N. U.	Ohio. ..	508 11th Street.
Hardy, Edward Hugh	Ala.	918 18th Street.
Hart, Timothy Joseph	N. Y. ..	1829 K Street.
Hartson, Clinton Henry	Wash. ..	1821 North Capitol St.
Henault, Thomas Ransel	D. C.	2016 G Street.
Hepburn, Louis Frederick Japy	Penn.	810 12th Street.
Hichborn, Philip Simmons	D. C.	1707 N Street.
Hindman, Albert C.	Penn.	1101 K Street.
Hinshaw, Howard Raymond	Neb	The Hamilton.
Holmes, Rexford Louie	Mo.	Civil Service Comm'n.
Hovey-King, Albert, Jr	Ill.	The Logan.
Hughey, Allen Harrison B.A., 1901, Vanderbilt University.	Texas ..	Geological Survey.
Hunt, Frank Edward	Ala.	1015 K Street.
Ilustre, Eustacio S.	Phil. Is.	War Department.
Jones, Charles Andrews	D. C.	1319 F Street.
Jones, Robert McGuire B.A., 1902, William and Mary College.	Va.	1516 21st Street.
Kellett, Joe Cabot B.S., 1905, Agricultural and Mechanical College, Alabama.	Ala.	The Geo. Wash. Univ.
Kester, Bruce Randall	Penn. ..	1024 14th Street.
Kiefer, Mahlon D.	N. Y. ..	Department of Justice.
Kilgour, Robert Mortimer	Mont. ..	1210 N Street.
Kilpatrick, Howard Malcolm	Ga.	307 Patent Office.
Keene, Elwood Ray	D. C.	Brightwood, D. C.
Knorr, Ernest August	D. C.	1618 14th Street.
Leary, James Wade	Mass. ..	St. James.
Leonard, John Mather	W. Va. .	1201 5th Street.
Levine, Michael	Wis. ..	1016 13th Street.
Low, Fred Henshaw	D. C.	1730 Connecticut Ave.
McClellan, George Browning	Hawaii..	The Cumberland.
McDonald, A. James	Colo.	737 Princeton Street.
McIntyre, Donald Knott	N. J.	The Crosby.
McLean, Edward Beale	Ohio. ..	1500 I Street.
MacMillan, James Blaine	Penn. ..	1349 L Street.
McNeal, Ira Bennett A.B., 1898, Dickinson College.	Penn.	1137 12th Street.
McNeill, Frank Augustus	Va.	1310 9th Street.
Maguire, Charlie Hugh B.S., 1905, University of Florida	Fla.	Driscoll Hotel.
Mancha, Henry Howard	Mich. ..	1301 K Street.
Manghum, Henry Emmet	D. C.	1320 12th Street.
Manghum, James Mason	D. C.	1320 12th Street.

Name.	Legal residence.	City address.
Mason, Randolph	Md.	1108 L Street.
Mayer, Theodore	D. C.	The Cumberland.
Melby, Charles Beach	Wis.	1217 K Street.
Micou, Richard Durrica	Va.	33. Home Life Bldg.
B.A., 1903, M.A., 1903, University of Virginia.		
Mikesell, Russell Everett	Ohio	Langdon, D. C.
Milburn, Henry Maurice	Mich.	1123 13th Street.
B.S., 1903, University of Michigan.		
Miller, Willian Lewis	D. C.	500 5th Street.
Mitchell, Paul	Penn.	516 13th Street.
B.A., 1905, Allegheny College.		
Mitchell, William Hadwen	Mass.	Rm. 311, Patent Office.
B.S. in Electricity, 1905, Worcester Polytechnic Institute.		
Murphy, William Ashford	Wash.	1103 10th Street.
Nava, Leon Julio	Iloilo	1024 17th Street.
Neal, Chester Frenholm	Mass.	1445 Massachusetts Ave.
B.A., 1905, Yale University.		
Neal, James William	Tenn.	P. O. Dept., Div. of Insp.
Nyemaster, Jesse Ray	Iowa	1221 13th Street.
Owen, Claud Worthington	Md.	913 F Street.
Owens, Charles Francis	Md.	908 15th Street.
Patterson, James Frosst	D. C.	618 Mills Building.
Perkins, Lewis Bryant	Va.	1119 I Street.
Peters, William J	Ohio	911 19th Street.
Phillips, Adon Daniel	N. Y.	1702 4th Street.
B.S., 1905, The George Washington University.		
Phillips, Ivon William	N. Y.	1702 4th Street.
Porter, Henry Gaylord	Cal.	907 H Street.
Pretzfelder, Leon	Va.	413 N. St. Asaph Street, Alexandria, Va.
Prouty, Ward	Vt.	The Portner.
Purcell, Armstead	D. C.	415 Florida Avenue.
Ramsey, George William	Ill.	1120 13th Street.
Rathbun, Don Seavey	Iowa.	208 Indiana Avenue.
B.S., 1904, Cornell University.		
Rehr, Paul Allen	Penn.	1736 G Street.
Reighley, John Henry	N. Y.	1807 G Street.
Reinohl, David Weimer	N. Y.	3339 17th Street.
Riddleberger, Harrison Heath	Va.	U. S. Senate.
Rodier, Henry Tait	D. C.	1334 Wallach Place.
Rosario, Ignacio A	Phil. Is.	1024 17th Street.
Russell, Arthur Jasper	Penn.	University Club.
Rutherford, Reginald	Md.	922 French Street.
Scantling, Philip Lee	D. C.	1213 New Jersey Ave.

Name.	Legal residence.	City address.
Schofield, Henry Kendrick	Miss	213 5th Street, N. E.
Sheridan, James MacDermott	Colo	1353 Harvard Street.
Shoemaker, Abner Cloud Pierce	D. C.	612 14th Street.
Smith, Dyer. M. E., 1903, Lehigh University.	Penn	The Woodley.
Smith, Ellison Griffith	S. Dak.	734 12th Street.
Smith, George Thomas	Md	Room 234, P. O. Dept.
Stein, Simon Bernard	Mass	904 Westminster Street.
Stevens, Herbert Ainsworth	Mass	904 12th Street.
Stevenson, Charles	N. Y.	1033 21st Street.
Stull, Howard William	Penn	Takoma Park, D. C.
Sunderlin, Louis Kossuth	Iowa	1242 12th Street.
Swayze, Samuel	N. J.	1614 R. I. Avenue.
Taylor, Louis Ralph	Ill	1303 R Street.
Tracey, Frederick H.	Ohio	614 M Street.
Turner, Robert Hite	Va	507 H Street.
Twyeffort, Frank Hubbard	N. Y.	1736 G Street.
Ulke, Titus. B.S., 1885, Columbian University. E.M., 1889, Royal Academy Mines, Freiberg, Saxony.	D. C.	411 15th Street.
Van Emon, Walter C.	Ill	203 D Street.
Vierra, George	Hawaii	2021 H Street.
Waters, William Clark	D. C.	5706 Brightwood Ave.
Weddell, Alexander Wilbourne	Va	1901 I Street.
Weed, Theodore Linus	D. C.	1231 Harvard Street.
Wells, Charles Shelley	W. Va.	3422 13th Street.
West, Louis Herman	Ky	3315 Newark Street, Cleveland Park.
West, William Kemper	Ky	1718 Corcoran Street.
Wilson, Albert Theodore	N. Y.	Navy Department.
Willis, Robert Chadwick. B.A., 1901, Guilford College.	N. C.	212 8th Street, N. E.
Whalley, William John	D. C.	1218 Georgia Ave., S. E.
White, Richard Drum	D. C.	1803 Belmont Avenue.
Whitten, William Henry, Jr. B.S., 1896, M.S., 1897, Massachusetts Institute of Technology.	Ill	1254 Columbia Road.
Wiggins, Ernest. B.A., 1899, Wafford College.	S. C.	222, Post Office Dept.
Williams, James Arthur	Iowa	615 5th Street, N. E.
Wilson, Ira Jay	Wis	1227 M Street.
Wood, Thomas	Ill	1905 Pennsylvania Ave.
Yocum, Wilbur Elmore. B.A., 1898, Florida Agricultural College.	Fla	1807 Phelps Place.

Second Year.

Acton, Robert Dow	Ill.	Department of Justice.
Agnew, Albert Conant	Ind. Ter.	1213 N Street.
Alden, Henry Palmer	D. C.	1308 S Street.
Amiss, T. Brooke, Jr.	N. Y.	The Plymouth.
Andrews, Edward Hank	Mich.	House of Reps.
Babcock, James Earle	D. C.	709 G Street.
Babcock, William	D. C.	709 G Street.
Baker, Arthur George B. A., 1903, Amherst College.	Mass.	Room 231, P. O. Dept.
Ballard, William Reed	Ind.	Rm. 103, Patent Office.
Barker, William Judson	D. C.	122 13th Street, S. E.
Barth, Fred	Ky.	Post Office Dept.
Bowyer, Joseph McCarter B.S., 1904, Princeton University.	Penn.	The Mendota.
Braddock, Ernest Reeves	Md.	1400 6th Street.
Brearton, James Mitchell	Ill.	767 10th Street, S. E.
Brown, Herbert Daniel	N. Y.	3360 Mt. Pleasant Street.
Buffington, William E.	Penn.	1501 11th Street.
Burlingham, Lloyd	N. Y.	903 13th Street.
Burriss, John Murray	Kans.	Room 436, P. O. Dept.
Carnes, Samuel Clifford	Ohio	921 G Street.
Christian, Charles Frederick	Ind.	1108 New York Avenue.
Collins, Frederick Albert	D. C.	125 10th Street, N. E.
Crain, Kenneth B. A., 1902, University of Louisville.	Ky.	1829 G Street.
Deller, Lester K.	Ind.	2017 Hillyer Place.
Duffey, Louis Nelson	Va.	Alexandria, Va.
Dunning, Daniel Alfred	Utah	3267 N Street.
Fitz Gerald, Shepler	D. C.	3515 Eslin Avenue.
Freeman, Paul	Ohio	1816 S Street.
Gammon, Nathan	Tenn.	929 K Street.
Ganett, George Everett	Va.	8 8th Street, S. E.
Garner, Henceford Noel	Va.	413 S. Fairfax Street, Alexandria, Va.
Gerry, Charles Fusting	Md.	Room 41, Sun Bldg.
Gilchrist, Walter Schell A.B., 1902, Georgetown University.	D. C.	652 Mass. Avenue, N. E.
Giles, Louis Edward B.S. in E.E., 1902, Columbian University.	Mich.	1608 15th Street.
Glennan, Arthur Wyman	Md.	Chevy Chase, Md.
Gordon, Alexander B. A., 1901, Yale University.	Penn.	Cedarhurst, Univ. Hill.
Gusack, Samuel Victor	N. Y.	921 Westminster Street.
Guyton, Joseph Daniel B. S. in Engineering, 1901, Mississippi Agricultural and Mechanical College.	Miss.	1715 G Street.

Name.	Legal residence.	City address.
Hallam, Paul Rankin	Ky.	504 Seward Square, S. E.
Hand, Robert G	Miss.	1216 Princeton Street.
B. S., 1899, Mississippi Agricultural and Mechanical College.		
Harding, Lee Robert	Iowa	Otterbourne, Md.
Hattersley, Ralph Marshall	Ohio	1317 Q Street.
Henkel, Myron Freeman	Ill.	706 20th Street.
Hogg, William Leonard	Colo.	1217 K Street.
B. A., 1904, Colorado College.		
Hoover, Dickerson Naylor, Jr.	D. C.	413 Seward Square, S. E.
Huffman, Charles Jones	Ill.	136 D Street, S. E.
Hunt, Risley G	D. C.	2110 H Street.
Irion, Harry	Colo.	414 A Street, S. E.
Johnson, Charles Edward	D. C.	406 Jackson Street.
Jones, William Phelps	N. Y.	920 C Street, N. E.
E.E., 1898, Columbia University.		
Keeler, Earle Leslie	Mass.	918 H Street.
Kennedy, John Thomas	Penn.	911 19th Street.
Langmade, Robert Grover	N. Y.	830 12th Street.
Law, Frank A. Jr.	D. C.	1627 14th Street.
Leech, Wilmer Ross	Md.	2302 1st Street.
Lees, Fred	Kans.	614 Md. Ave., N. E.
B.A., 1900, Washburn College, Topeka, Kansas.		
Lewis, Henry Latané	Md.	1413 G Street.
Lewis, William J	N. H.	303 7th St., N. E.
Lundy, Elmer Johnston	Ark.	1613 13th Street.
B.S., 1899, Dickson College.		
McCathran, Wallach A	D. C.	916 Penn. Avenue, S. E.
McLean, Hubert Gilbert	Mich.	M.S.O., War Dept.
Manning, Lawrence W	Ky.	1223 15th Street.
Mead, Thomas L., Jr.	Ohio	3022 R Street.
Ph.B., 1901, Western Reserve University.		
Melby, Charles Beach	Wis.	1217 K Street.
Merrill, Henry P.	D. C.	1760 Willard Street.
Moore, Robert Irwin	Tenn.	1322 L Street.
B.A., 1898, Vanderbilt University.		
Morris, Charles Meyer	Utah	1132 12th Street.
Packard, Edwin Augustus	Mass.	Patent Office.
B.S., 1899, Massachusetts Institute of Technology.		
Patchin, Ira H	Iowa	916 19th Street.
Patterson, Mathew Warren	Ark.	1391 F Street, N. E.
Peake, William Thomas	D. C.	121 10th Street, N. E.
Prettyman, William Forrest	Md.	Rockville, Md.
A.B., 1903, M.A., 1904, Randolph-Macon College.		
Roberts, Ora Herbert	Ind.	708 10th Street.
Roche, Sidney	D. C.	1325 1st Street.

Name.	Legal residence.	City address.
Ross, Montague Sutton	Tenn.	815 12th Street.
B.A., 1903, University of Nashville.		
Salsbury, Burt Freeman	Va.	Merrifield, Va.
Schommer, John B	Wis.	1215 I Street.
Smith, Albert Edward	Wis.	4426 8th Street.
LL.B., Howard University.		
Smith, John Abdiel	Penn.	1108 New York Avenue.
Stadden, Corry Montague	Ohio	3002 13th Street.
Starek, Frank Jerome	Ohio	2024 G Street.
Steenerson, Benjamin Gilbert	Minn.	1902 H Street.
Stewart, Edward S	Md.	1121 8th Street.
Sutherland, William Alexander	D. C.	1700 L Street.
B. Sc., 1898, Agricultural and Mechanical College, New Mexico.		
Swank, Walter Ray	Colo.	804 19th Street.
Taylor, Rowland Corwin	Ohio.	921 G Street.
Thomas, Enfield Hoge	Va.	937 I Street.
Tibbets, Frank James, Jr	D. C.	1636 17th Street.
Thomson, William Enos	Ill.	Treasury Department.
Thorpe, Merle Harold	Cal.	2024 G Street.
Toohey, Frank	Mass.	800 L Street.
Tuckerman, Walter R	D. C.	1515 Mass. Avenue.
B.A., 1903, Harvard University.		
Tutwiler, Strudwick Young	Ala.	929 K Street.
Tyler, Frank E	Miss.	U. S. Geol. Survey.
Van Smith, George Attson	Minn.	131 A Street, N. E.
Wallace, Reuben Staten	Md.	206 Elm Street.
Washington, Richard Blackburn	Va.	Library of Congress.
Wayman, Edward F., Jr	Va.	1013 8th Street.
Weeks, Edward Mitchell	Penn.	Cleveland Park, D. C.
Weir, Taylor B	Va.	Dept. of Agriculture.
Whippler, Frederick R	D. C.	The Don Carlos.
Williams, Henry Trumbull	Mass.	Patent Office.
B.S., 1903, Harvard University.		
Williamson, James McGowan	D. C.	1210 S Street.
Winbourn, Robert Emmet	Colo.	1019 P Street.
Woodward, Franklin Tuthill	D. C.	915 S Street.
B.A., 1901, Dickinson College.		
Woolverton, William Hand	Miss.	1216 Princeton Street.
B.A., 1903, Dartmouth College.		

Third Year.

Alden, Levi Russell	D. C.	809 L Street.
A.B., 1903, A.M., 1904, Columbian University.		
Armstrong, Ernest Patterson	Iowa	711 K Street.
LL.B., 1902, National University.		

Name.	Legal residence.	City address.
Badger, Carl A.	Utah	De Soto, Room 31.
Barker, John Richard	N. C.	1101 13th Street.
Barton, Harry R.	S. Dak.	1727 Grant Street.
Bates, Luther Eugene B.A., 1898, Mississippi College.	Miss.	23 1st Street, N. E.
Behymer, Glenarvon	Cal.	1101 13th Street.
Beeler, Adam M	Ind.	1902 H Street.
Biggs, John Sherman LL.B., 1901, Kansas City Law School.	Kans.	1241 Evarts St., N. E.
Blessing, Riley Andrew	W. Va.	151 C Street, N. E.
Booth, Clarence M.	Ind.	2002 G Street.
Bouic, Charles Norman	Md.	Rockville, Md.
Burnstine, Marcus Henry	D. C.	1122 13th Street.
Busch, Simon Henry	Minn.	735 13th Street.
Butz, David Hazen B.A., 1895, Lafayette College.	Penn.	510 8th Street, S. E.
Cheney, Morton Mead	N. H.	Library of Congress.
Clark, Frederick Francis	D. C.	504 E Street.
Codington, Arthur Henry LL.B., 1902, Mercer University.	Ga.	150 E Street, N. E.
Coflin, Charles Buxton	S. C.	1116 15th Street.
Cohen, Louis	Wis.	702 19th Street.
Cooke, Levi.	N. Y.	1305 30th Street.
Cox, Percy Murtaugh M.D., 1899, Columbian University.	Md.	Department of Justice.
Crist, Lucien Bainbridge	D. C.	The De Soto.
Croissant, Victor George	Wash.	18 Tenn. Ave., N. E.
Cross, Arthur Emerson LL.B., 1905, University of Washington.	Wash.	1121 I Street.
Cunningham, John Benedict	W. Va.	822 Connecticut Avenue.
Davids, Berkeley Reynolds	Penn.	1523 L Street.
Davidson, Herbert King, Jr.	Mass.	921 11th Street.
Davis, Arthur Llewellyn	Ill.	1970 California Avenue.
Dobbins, Donald Claud	Ill.	Post Office Dept.
Douglass, Lloyd Augustus	D. C.	1112 6th Street.
Dresser, Jasper Marion B.S., 1890, Purdue University.	Penn.	1722 Mass. Avenue.
Fisher, Arthur Ames	D. C.	Treasury Department.
Flowers, Allen Gilbert	S. C.	The Carolina.
Frayser, Frank	Va.	Room 224, P. O. Dept.
Ford, Edgar Werner	N. Y.	824 9th Street, N. E.
Ford, Harvey	W. Va.	2115 S Street.
Fowler, Wilbur Walter	Mass.	3409 Holmead Avenue.
Fullam, Edwin Winfield	N. J.	War Department.

Name.	Legal residence.	City address.
Fuller, Charles Franklin	N. Y.	718 6th Street, N. E.
B.S., 1901, The George Washington University.		
Furbershaw, Walter Louis	N. Y.	Pension Bureau.
Garnett, Philip	N. H.	1347 U Street.
George, Horace Reid	Penn.	941 O Street.
Goodall, Milo B.	Wis.	427 15th Street, N. E.
Groomes, Leonard Weer	Md.	1405 New York Avenue.
Handy, Wallace Stuart	Del.	The Geo. Wash. Univ.
Harralson, Morris K	Ga.	1016 15th Street.
Hazard, Elmont Bibb	D. C.	320 E Street, N. E.
Hodges, Lewis	D. C.	1607 Kenesaw Avenue.
Hopkins, Fred Merriam	Mich.	U. S. Patent Office.
B.S., 1902, University of Michigan.		
Hurd, Sumner Webster	N. J.	427 4th Street.
Jones, Willie Parker	Mass.	Dept. of State.
B.A., 1898, Tufts College.		
Jordan, Cornelius Hughes	Tenn.	The Fredonia.
Kent, Frank Joseph	Ind.	Colorado Building.
B.A., 1902, Bethany College.		
Keyes, Walter Edwin	Oregon.	1103 13th Street.
LL.B., 1905, Oregon University of Law.		
Lerch, Harry Ferdinand	D. C.	1320 F Street.
McGee, Leroy A	Wis.	1215 Lamar Place.
McLean, Donald Holman	N. J.	2002 G Street.
McNamee, Tom Crane	S. Dak.	Driscoll Hotel.
Mahon, John Wilfred	Ohio.	The Carlisle.
Meyers, Herbert Walter	Md.	Pension Bureau.
Milhado, Alexander Gordon	D. C.	1111 17th Street.
Muhleman, Donald Cassius	D. C.	1512 8th Street.
Moore, Frederick McCullough	Md.	Stratford Hotel.
Morris, Charles Wesley	D. C.	The Leamington.
Morris, Jackson	Ky.	Internal Revenue Bureau
Munn, Henry Farwell	D. C.	1334 R Street.
Neal, Albert Boyd	Tenn.	War Department.
Newmyer, Alvin Leroy	D. C.	2215 14th Street.
Nixon, John Thomas	N. H.	921 11th Street.
Paddock, William Waterman	Iowa.	1521 Vermont Avenue.
Parsons, George W.	Mich.	Post Office Dept.
Phillips, Francis John	N. Y.	Bur. of Immigration.
Phillips, Peter John	Md.	2021 H Street.
Pollock, Andrew Gray	Va.	207, The Plaza.
Price, James Hardy	S. C.	222 Kentucky Ave., S. E.
Prince, Earle Seaton	D. C.	742 New Jersey Avenue.

Name.	Legal residence.	City address.
Quigley, Richard John Francis	N. Y.	506 1st Street.
Reed, Edward Leckey	Ohio	1003 F Street.
Rhoads, William Levengood	Penn	2824 Brightwood Ave.
Richardson, Daniel J	N. Y.	240 12th Street, S. E.
Ph.B., 1903, Syracuse University.		
Riddell, Charles Francis	Wash.	U. S. Patent Office.
A.B., 1901, Leland Stanford University.		
Sams, Eldon E	Iowa	1306 L Street.
Ph.B., 1897, Nebraska Wesleyan University.		
Sanders, Franklin Oliver	Penn	706 11th Street.
Sell, John Carlisle	D. C.	139 C Street, N. E.
Shaw, William Furman	Ky.	919 New York Avenue.
Shelton, Leonard G	Miss.	1715 G Street.
B.S., 1901, Mississippi Agricultural and Mechanical College.		
Shepherd, Arthur Charles	Wis	Hyattsville, Md.
Shipper, Alva Hamilton	W. Va.	211 C Street.
Shore, Howard J	N. C.	1002 H Street, N. E.
Simpson, James T	N. H.	Treasury Department.
Sleman, Paul Edwin	D. C.	3114 16th Street.
Smith, James Cheetham	Penn	1208 E. Capitol Street.
Sommers, Walter Allwood	N. Y.	657 F Street, N. E.
LL.B., 1905, St. Lawrence University.		
Starr, David Judson	Ohio	1725 De Sales Street.
Steele, Benjamin U	Ky.	303 E Street, N. E.
Stern, Morris	Wis	The Lincoln.
Stetson, Frank	D. C.	1324 12th Street.
Swingle, Edwin Allan	D. C.	807 T Street.
Taggart, Giles Russel	N. J.	Bureau of Corporations.
B.S., 1900, Columbian University.		
Tilden, Myron Winfield	Conn	1101 13th Street.
Towles, Therrett	D. C.	3416 14th Street.
Transom, Frederick	Penn	2121 1st Street.
B.S. in M.E., 1895, University of Pennsylvania.		
Voorhis, Charles D.	N. J	Hotel Cairo.
Waite, William Franklin	Ala.	2831 11th Street.
Walker, Horacio	Chile	Chilian Legation.
Wallis, William James	N. H.	417 A Street, S. E.
B.A., 1894, Dartmouth College.		
A.M., 1899, Columbian University.		
Weitzel, Fred. William	Ky.	1317 Q Street.
Whitcomb, David	N. Y.	Cosmos Club.
B.A., 1900, and M.A., Amherst College.		
Williams, James Dawson	Md.	602 11th Street.
B.A., 1902, Western Maryland College.		

Name.	Legal residence.	City address.
Wilmeth, Warner L	Texas.	1246 Md. Ave., N. E.
Wilmot, Wilson Eardley	N. Y.	2224 F Street.
Wilmoth, Grover C.	Texas.	500 T Street.
Woods, Walter Orr	Kans.	913 Massachusetts Ave.
Woodwell, William Herbert	N. H.	418, Bond Building.

Special.

Name.	Legal residence.	City address.
Ammen, William Wetherall	Md.	Room 325, Patent Office.
B.A., 1903, Johns Hopkins University.		
B.S., Naval Architecture, 1905, Massachusetts Institute of Technology.		
Arroyo, Julian Aveline	D. C.	1317 F Street.
LL.D., 1897, Central University, Venezuela.		
Boyd, William Rufus, Jr	Texas.	The Litchfield.
Brosius, Samuel Martin	D. C.	McGill Building.
LL.M., 1904, The George Washington University.		
Clark, Gilbert Andrew	D. C.	605 F Street.
Corpus, Rafael	Phil. Is.	1308 R Street.
Cothrin, Foye.	Cal.	2024 G Street.
Davidson, Edwin R.	Mass.	1006 Massachusetts Ave.
LL.B., 1905, Georgetown University.		
Dodd, Walter Farleigh	Fla.	210 A Street, S. E.
A.B., 1898, Florida State College.		
B.S., 1901, Stetson University.		
Ph.D., 1905, University of Chicago.		
Faulkner, Robert Nelson	Cal.	Pension Office.
LL.B., 1904, LL.M., 1905, National University.		
Harding, Harvey Almon	Neb.	524 D Street, N. E.
Lewis, Junius Poullain	Ga.	1316 L Street.
B.A., 1902, University of Georgia.		
Mears, George Edwin	Mass.	1717 De Sales Street.
B.A., 1904, Williams College.		
Phair, Philip De Witt.	Maine.	131 A Street, N. E.
B.Litt., 1904, Trinity College.		
B.A., 1905, Harvard University.		
Richmond, Carl Adams	Cal.	1241 Princeton Street.
B. S., 1900, Pomona College.		
Staples, Eugene Washington	Maine.	814 11th Street, N. E.
Swan, John Thomas	D. C.	1340 R Street.
Whitehead, Robert F.	Va.	1427 R Street.
M.A., 1893, University of Virginia.		
Whittinghill, Jackson Pate	Ky.	1313 N Street.
B.S., 1903, Agricultural and Mechanical College, Kentucky.		
Woolsey, Lester Hood	N. Y.	1404 Park Street.
B.A., 1901, Harvard.		

Review.

Name.	Legal residence.	City address.
Anderson, Edward Dunning LL.B., 1903, M. P. L., 1904, Columbian University.	D. C.	2813 14th Street.
Baldwin, Julius Lyman LL.B., 1905, The George Washington University.	N. Y.	1358 Kenyon Street.
Bell, David Wilkinson LL.B., 1903, Columbian University. LL.M., 1905, Georgetown University.	N. C.	1331 Kenesaw Avenue.
Beller, James William LL.B., 1905, The George Washington University.	W. Va.	1246 Princeton Street.
Bone, Leonie LL. B., 1905, The George Washington University.	Ill.	Pension Office.
Brewer, John LL.B., 1903, Columbian University.	Md.	631 Pennsylvania Ave.
Browne, Frederick William LL.B., 1901, Columbian University.	Iowa	1104 12th Street.
Butler, Timothy John LL.M., 1901, D.C.L., 1902, Columbian University.	Kans.	1300 L Street,
Cole, Charles Orlando LL.B., 1905, The George Washington University.	Okla.	Treasury Department.
Cutting, Silas Henry LL.B., 1905, The George Washington University.	Mich.	1305 H Street.
Davis, Charles William LL.B., 1903, Columbian University.	Kans.	Room 13, Home Flats.
Day, Leonard B.S., 1902, Worcester Polytechnic Institute. LL.B., M.P.L., 1905, The George Washington University.	Mass.	U. S. Patent Office.
Fox, Carlton LL.B., 1905, The George Washington University.	N. J.	340 Indiana Avenue.
Franklin, Blake LL.B., 1904, Columbian University.	Ill.	General Land Office.
Fulgham, Hamden McKey LL.B., 1903, Columbian University.	Miss.	1347 L Street.
Gaddess, Eugene L. LL.B., 1905, The George Washington University.	Va.	1419 R Street.
Goode, Mark LL.B., 1905, The George Washington University.	Ill.	1319 Emerson Street.
Graves, J. Morris LL.B., 1905, The George Washington University.	Mo.	1103 17th Street.
Hall, Mortimer Beecher B.A., 1896, Columbian University. LL.B., 1905, The George Washington University.	Md.	Gaithersburg.
Hanes, Harvey Earlton LL.B., 1905, The George Washington University.	Va.	Room 152, Navy Dept.

Name.	Legal residence.	City address.
Harris, Nathaniel B.A., 1900, A.M., 1901, Baylor University. M.A., 1902, Yale University. LL.B., 1904, The George Washington University.	Texas	The Montgomery.
Hellerstedt, Carl John. LL.B., 1905, The George Washington University.	Tenn.	1220 W Street.
Henderson, William Bennett LL.B., 1892, Cumberland University. LL.M., 1904, Columbian University.	Ky	22 Grant Place.
Hengstler, Herbert C. LL.B., 1905, The George Washington University.	Ohio	38 Florida Avenue.
Hickox, Birdette P. LL.B., 1905, The George Washington University.	Mich	Room 123, Treas. Dept.
Hills, Ralph Warren B.S., 1897, Columbian University. LL.B., 1905, The George Washington University.	Ohio.	The Marlborough.
James, Charles G LL.B., 1905, The George Washington University.	Ohio.	1331 Vermont Avenue.
Jenks, Royal Granville LL.B., LL.M., 1904, Columbian University.	La.	951 Massachusetts Ave.
Johnson, Walter Slicer LL.B., 1905, The George Washington University.	Wash.	1746 Willard Street.
Leach, Boynton McConnel B.S., 1901, LL.B., 1904, The George Washington University.	Va.	1804 M Street.
Logan, Charles Bryce LL.M., 1905, The George Washington University.		
McCormick, Alexander Hugh, Jr. LL.B., 1905, The George Washington University.	Va.	2910 14th Street.
McMahon, John Patrick LL.B., 1905, The George Washington University.	D. C.	1441 S Street.
Marine, Clarence Leroy LL.B., 1905, The George Washington University.	Neb	The Portner.
Moore, Langdon LL.B., M.P.L., 1905, The George Washington University.	N. Y.	1755 P Street.
Newmyer, Edwin Jonathan LL.B., 1905, The George Washington University.	Mo.	1225 N Street.
Patterson, Morton C. LL.B., 1892, Columbian University.	Tenn.	824 G Street, N. E.
Pitts, George Bassett LL.B., 1904, Georgetown University. M.P.L., 1905, The George Washington University.	D. C.	507 E Street.
Plant, Arthur George LL.B., 1901, Columbian University.	D. C.	Care of Trad'rs' Nat. B'k.
Plumley, Walter Preston LL.B., 1901, Columbian University.	D. C.	Rm. 14, Atlantic Bldg.

Name.	Legal residence.	City address.
Reinohl, W. Parker LL.B., 1901, Columbian University.	D. C.	912 F Street.
Rickard, James B. LL.B., 1905, The George Washington University.	Hawaii.	Office Sec. of Interior.
Russell, William H. LL.B., 1904, The George Washington University.	Penn.	1240 Princeton Street.
Scott, Thomas Allen LL.B., 1904, Columbian University. B.S., 1893, Kansas Normal College.	Mo.	1245 Evarts St., Br'kl'd.
Searle, William Daniel LL.B., 1905, The George Washington University.	N. Y.	1131 12th Street.
Smith, Homer A. A. Ph.B., University of Chicago. LL.B., 1901, Columbian University.	Colo.	721 Princeton Street.
Snell, Arthur Veeder B.L., 1899, Hobart College. Ph.B., 1900, University of Chicago. LL.B., 1905, The George Washington University.	N. Y.	3016 Dumbarton Ave.
Stutler, Delmas Clay LL.B., 1905, The George Washington University.	W. Va.	316 M Street.
Tharin, Frank LL.B., 1893, LL.M., 1902, Columbian University.	S. C.	War Department.
Waterman, Jason LL.B., 1903, The George Washington University.	Mich.	64½ Bates Street.
Wilson, Thomas Benton LL.B., 1902, Columbian University.	Wash.	2320 1st Street.
Young, Eugene LL.B., 1905, The George Washington University.	D. C.	804 7th Street.

Master of Laws.

Allis, Frank Coy LL.B., 1903, Cornell University.	N. Y.	936 K Street.
Barker, Frederick Francis LL.B., 1891, Cambridge University, England.	Texas.	War Department.
Brooke, John Cooke B.S., 1901, Virginia Polytechnic Institute. LL.B., 1905, Georgetown University.	Va.	820 6th Street.
Bruff, James L. LL.B., 1903, University of Virginia.	N. J.	820 6th Street.
Clark, Walter LL.B., 1905, University of North Carolina.	N. C.	1337 L Street.
Gaskill, James Robbins, Jr. LL.B., 1905, The George Washington University.	N. C.	2024 G Street.
Gilmer, Branner LL.B., 1905, University of North Carolina.	N. C.	1337 L Street.

Name.	Legal residence.	City address
Jenkins, Charles	Ky	65 N Street.
LL.B., 1903, Georgetown University.		
Landry, Luke Valcour	La	1519 Rhode Island Ave.
LL.B., 1896, Tulane University.		
McDuffie, Phillips Campbell	Md	1016 13th Street.
LL.B., 1905, Wake Forest College, N. C.		
Williams, William Kingsley	Wyo	807 L Street.
B.A., 1900, Yale University.		
LL.B., 1903, University of Nebraska.		

Review.

English, Walter Charles	D. C.	2907 P Street.
LL. M., 1905, The George Washington University.		
Flournoy, Richard Wilson	Md.	State Department.
LL.B., 1904, Columbian University.		
LL.M., 1905, The George Washington University.		
Mitchell, Andrew S.	Ohio	921 8th Street.
LL.M., 1904, Columbian University.		

Master of Patent Law.

Bayard, Fairfax	D. C.	1325 Kenesaw Street.
LL.B., National University.		
C.E., Lehigh University.		
Beeler, George Lowman	Ill.	807 B Street, S. E.
B. S., 1899, The Columbian University.		
LL.B., 1902, National University.		
Bon Durant, Edgar Hamilton	Iowa	Mt. Rainier, Md.
LL.M., 1903, National University.		
Boughton, Walter White	Ohio	Patent Office.
LL.B., 1905, National University.		
B.S., 1902, Case School of Applied Science.		
Brumbaugh, Noah J.	Mo.	Patent Office.
B.A., 1896, Harvard University.		
LL.B., 1904, National University.		
Byllesby, Ellis Buchanan	D. C.	1404 M Street.
LL.B., 1905, National University.		
Carnes, John Henry	N. J.	Patent Office.
LL.B., 1904, National University.		
Church, Durant	D. C.	603 McGill Building.
LL.B., 1905, Notre Dame.		
Comstock, Nathan	Wis	9 Grant Place.
LL.B., 1900, University of Wisconsin.		
Cook, Richard John	Ark.	2024 G Street.
LL.B., 1905, National University.		
Drysdale, James Murray	Colo.	Patent Office.
LL.B., 1905, National University.		

Name.	Legal residence.	City address.
Dyke, Herbert H. B.A., 1899, Marietta. M.S., 1903, Columbian University. LL.B., 1905, National University.	Ill.	53½ Bates Street.
Fairbank, Clair Wesley B. S., 1904, Columbian College. LL.B., 1905, National University.	Minn.	3107 16th Street.
Glass, Roy Chester LL.B., 1905, National University.	D. C.	1524 Columbia Street.
Griffin, Carlcs Parker B.S., 1901, University of California. LL.B., 1905, National University.	Cal.	1108 8th Street.
Hutchinson, George Alexander LL.B., 1905, The George Washington University.	D. C.	927 F Street.
Kirk, George Ellis B.S., 1904, Columbian University. M.E., 1905, The George Washington University.	Ohio.	Milwaukee, Wis.
Lahke, Arthur Henry LL.B., 1904, LL.M., 1905, National University.	Ohio.	Gov't Printing Office
Leach, Boynton McConnel B.S., 1901, LL.B., 1904, The George Washington University.	Va.	1804 M Street.
Margeson, Wylie Churchill B. A., 1897, Harvard University. LL.B., 1903, University of Minnesota.	Mich.	1361 Harvard Street.
Morse, Howard Moore B.S., 1902, Worcester Polytechnic Institute. LL.B., 1905, The George Washington University.	Mass.	University Club.
Moses, Edmund Quincy B.S., 1902, Harvard University. LL.B., 1905, The George Washington University.	Mass.	The Sheridan.
Povey, Richard G. B. S., 1901, Wesleyan University. LL.B., 1905, The George Washington University.	Conn.	Patent Office.
Schley, George Bigelow LL.B., 1905, The George Washington University. B.S., 1902, M.A., 1903, Kenyon College.	Ohio	1336 W Street.
Shaffer, Charles Henry B.S., 1896, St. John's College. LL.B., 1905, The George Washington University.	Md.	1303 Clifton Street.
Sperl, William John LL.B., 1905, The George Washington University.	Mass.	3573 10th Street.
Thomas, Adolph Alexander	Ohio	Patent Office.
Thompson, Edward Cyrus B.S., 1901, M.E., 1902, Columbian University. LL.B., 1905, National University.	Iowa	1641 13th Street.
Transom, Frederick B.S., 1895, University of Pennsylvania.	Penn.	2121 1st Street.

Name.	Legal residence.	City address.
Underwood, Lineas Dott	D. C.	2818 13th Street.
B.S., 1899, Columbian University.		
Wesseler, William Julius	Mo.	103 I Street.
B.A., 1900, Washington University.		
LL.B., 1902, St. Louis Law School.		
LL.M., 1905, The George Washington University.		
Wright, Arthur	Md.	The Mendota.
B.A., 1900, Johns Hopkins University.		
Wyman, William I.	Mass	319, Patent Office.
M.P.L., 1905, The George Washington University.		

Review.

McClair, Charles	Kans	Patent Office.
B.A., 1899, Kansas University.		
M.P.L., 1905, The George Washington University.		
Porter, Minott Eugene	Ohio	1517 35th Street.
B.S. in C.E., 1893, C.E., 1898, University of Michigan.		

Doctor of Jurisprudence.

Castellot, José	Mexico.	Mexican Embassy.
B.A., 1899, Institute Campechano.		
LL. B., 1904, National School of Jurisprudence, Mexico.		

Auditors.

Day, Stephen Albion	Mich	1301 Clifton Street.
B.A., 1905, University of Virginia.		
Geissler, Mahlon Hobart	Conn	929 L Street.
Hammond, Frank Earl	Iowa	House of Reps.
LL.D., 1900, Iowa University.		

Summary.

CANDIDATES FOR THE LL.B. DEGREE:

First year	173	
Second year	106	
Third year	115	
		394
Special	19	
Review	52	
		71
Candidates for the LL.M. degree	11	
Review	3	
		14
Candidates for the M.P.L. degree	34	
Review	2	
Candidate for the Jur. D. degree	1	
Auditors	3	
		40
Total		519

DEPARTMENT OF POLITICS AND DIPLOMACY.

Master of Diplomacy.

Name.	Legal residence.	City address.
Caldwell, Winfield Scott	N. Y....	136 W. 139th St., N. Y.
LL.M., 1905, The George Washington University.		
Dorsey, Roscoe J. C	Penn ...	1217 I Street.
LL.B., 1902, LL.M., 1903, Georgetown University.		
Duras, Victor Hugo.	Neb.....	2000 F Street.
LL.B., 1902, University of Nebraska. LL.M., 1903, Columbian University.		
Dye, John Walter.	Minn....	1514 K Street.
B.A., 1904, University of Minnesota.		
Green, Andrew Jordan	Va......	1343 Clifton Street.
LL.B., 1887, National University. LL.B., 1888, LL.M., 1889, Georgetown University. LL.M., 1905, The George Washington University.		
Haas, Charles Edmund......	Cal.....	2018 G Street.
B.A., 1898, Leland Stanford University.		
Merritt, Leonard Atkins.......	Minn...	154 F Street, S. E.
LL.B., 1904, Columbia University. LL.M., 1905, The George Washington University.		
Miller, Clarence Alfonso....	Mo.....	Bureau of Corporations.
LL.B., 1899, Kansas City School of Law. LL.M., 1905, The George Washington University.		
Plumacher, Blas Guillermo..........	Ven	916 Massachusetts Ave.

Doctor of Civil Law.

Name.	Legal residence.	City address.
Dorsey, Roscoe J. C................	Penn....	1217 I Street.
LL.B., 1902, LL.M., 1903, Georgetown University.		
Gow, Bernard Arthur................	Mo. ...	921 8th Street.
LL.B., 1896, Missouri State University. LL.M., 1904, Columbian University.		
Green, Andrew Jordan.	Va......	1343 Clifton Street.
LL.B., 1887, National University. LL.B., 1888, LL.M., 1889, Georgetown University. LL.M., 1905, The George Washington University.		
Heimbeck, Adolph James	Iowa....	Auditor for Treas. Dept.
M. Dip., 1905, The George Washington University.		
Oberlin, Paca	Va......	1238 5th Street.
LL.B., 1903, LL.M., 1904, Colorado University. M.Dip., 1905, The George Washington University.		
Saxton, Howard	Neb.....	103 I Street.
LL.B., 1901, University of Nebraska. LL.M., 1904, Columbian University.		

Doctor of Philosophy.

Name.	Legal residence.	City address.
Miyakawa, Masuji	Ind.	Geo. Washington Hotel.
LL.B., 1902, University of Indiana.		
LL.M., 1903, Columbian University.		
LL.D. 1904, Southern University.		
D.C.L., 1905, Illinois College of Law.		
Slechta, Joseph John	S. Dak.	807 H Street.
B.A., 1904, M.A., 1905, University of South Dakota.		

Special.

Bacon, James Everett	Neb.	807 18th Street.
Bailey, Emma Reba	Ga.	Hotel Bancroft.
LL.B., 1899, LL.M., 1901, Washington College of Law.		
LL.M., 1902, Columbian University.		
D.C.L., 1903, The George Washington University.		
Baker, Roswell Edward	D. C.	Wash. Loan & Trust Co.
Calvert, John Wentworth	D. C.	1750 Corcoran Street.
Drum-Hunt, Richard Coulter	Md.	Wash. Loan & Trust Co.
Freebey, Harriet	D. C.	The Rochambeau.
LL.B., 1904, University of Michigan.		
LL.M., 1905, The George Washington University.		
Kasugai, Jotaro	N. Y.	1126 25th Street.
Shogyo College, Japan; University of Pennsylvania in 1905.		
March, Alden	Mass.	1421 K Street.
Phelps, Horace J.	Mo.	The Iowa.
Schulz, Johan Wilhelm Bruno	Va.	228 Morgan Street
B.A., 1894, Concordia College.		

Summary.

Candidates for the M.Dip. degree	9
Candidates for the D.C.L. degree	6
Candidates for the Ph.D. degree	2
Special	10
Total	27

NATIONAL COLLEGE OF PHARMACY.

Doctor of Pharmacy.

Seniors.

Name.	Legal residence.	City address.
Bennett, Fred C.	Eng.	553 Jef's'n St, Anacostia
Criswell, Miss Addie P. S.	D. C.	1737 13th Street.
Dieter, L. V.	Md.	323 B Street, N. E.
Downey, Mrs. W. C.	Ohio	2473 18th Street.

Name.	Legal residence.	City address.
Geoghegan, Miss Isadora	D. C.	111 4th Street, N. E.
Goldsmith, M. L.	D. C.	429 R Street.
Grady, J. Wilton	S. C.	484 Penn. Avenue.
Johnson, H. J.	D. C.	1103 3d Street.
Judd, B. S	D. C.	7th and F Streets, S. W.
Keech, Jas. E.	Md.	15th and U Streets.
Kem, Claude J.	Colo.	1111 S Street.
Lantz, H. H.	Va.	7th and H Streets, N. E.
Larrick, B. B.	Va.	15th and H Streets, N. E.
Linton, F. T	Md.	N. Cap. St. and Fla. Ave.
McAuley, H. S.	D. C.	1141 8th Street.
Mattingly, D. J.	Md.	Tacoma Park.
Miskimon, R. R.	Del.	254 11th Street, S. E.
Nordeman, Miss Hazel	Ill.	411 1st Street, N. E.
Nordeman, Miss Agnes M.	Ill.	411 1st Street, N. E.
Nelson, Cyrus W.	Okla.	1st and C Streets.
O'Donnell, Miss N. G	D. C.	32d and O Streets.
Richardson, Earle K.	Ohio	1518 12th Street.
Sudler, Mrs. O. R.	Ill.	5th and H Streets.

Juniors.

Name.	Legal residence.	City address.
Colby, Herman H.	N. Y.	U. S. S. *Puritan.*
Day, A. N	N. J.	E. Capitol and 11th Sts.
Everett, Jas. T.	D. C.	127 12th Street, N. E.
Gulick, R.	D. C.	14th St. and N. Y. Ave.
Jacobs, John R.	N. Y.	419 H Street.
Keister, John T.	Va.	Agricultural Dept.
Kisseleff, John.	Russia.	N. Capitol and L Sts.
Laubinger, Louis.	Ger.	228½ Q Street.
Leatherland, Lawrence C	Va.	212 N. Alfred Street, Alexandria, Va.
Madigan, Robert E.	D. C.	432 Monroe Street, Anacostia.
Myers, Robert I.	D. C.	120 Florida Avenue.
Nelson, Miss S.	Okla.	1st and C Streets.
O'Neill, A. J	D. C.	710 10th Street, N. E.
Pitzer, F. H.	D. C.	5th and E. Capitol Sts.
Preuss, Benno R	Texas	227 P Street.
Richardson, Miss M. H	Ohio.	3d and Penn. Avenue.
Rickards, L. B. W	N. J.	631 Mass Ave., N. E.
Sacks, L.	Ger.	3223 M Street.
Schulze, Gustave H., Jr.	D. C.	1751 L Street.
Spire, W. Burton	N. Y.	1120 C Street, S. W.
Thompson, Milton C.	D. C.	1006 D Street, S. E.
Wiley, R.	Okla.	College Station, Prince George Co., Md.

Freshmen.

Name.	Legal residence.	City address.
Boyer, W. Roby	Md.	14th and P Streets.
Buckman, M. M	Minn.	National Hotel.
Deming, C. G.	D. C.	907 K Street.
De Vaughan, Lewis H	Va	412 King Street, Alexandria, Va.
Eppard, Geo. I.	Va	808 I Street.
Floyd, H. B.	Ark	1112 10th Street.
Harris, Eugene	D. C.	608 Albany Street, N. E.
Hughes, H. D.	D. C.	1325 29th Street.
Johnson, C. J	D. C.	922 F Street.
Lusby, Roger W	Md.	714 A Street, N. E.
Nolan, J. I.	Ill.	116½ 5th Street, N. E.
Owens, Joseph J	Md.	1225 B Street, S. E.
Pozen, M	D. C.	626 H Street.
Reh, C.	D. C.	5th and G Streets.
Salb, G. R	D. C.	617 9th Street, N. E.
Schroeder, Robert M	D. C.	524 9th Street, S. E.
Senay, H. J	D. C.	916 9th Street.
Silcott, E. W.	D. C.	Cleveland Park.
Simmons, J. W	D. C.	36th and O Streets.
Souder, Willard L	Md.	11th and S Streets.
Spencer, R. Bruce	N. C.	Falls Church, Va.
Sprague, V. H	Ill.	9th and Penn. Avenue.
Steele, Ernest H	Va.	54 I Street, N. E.
Taltavull, Harold J	D. C.	601 6th Street, S. W.
Thibadeau, Richard B	Ga.	316 4½ Street S. W.
Thorn, W. D	D. C.	412 35th Street.
Timberlake, T. O	Va.	524 9th Street, S. W.

Summary.

CANDIDATES FOR THE PHAR. D.:

Seniors	23
Juniors	22
Freshmen	27
Total	72

PART V.

DEGREES CONFERRED, MISCELLANEA.

Degrees Conferred at Commencement, 1905.

HONORARY.

Doctor of Divinity.

Rev. Charles Hastings Dodd.

Master of Laws.

Theodore P. Ion.

IN COURSE.

Doctor of Philosophy.

Ray Smith Bassler, Ohio.
A.B., 1902, University of Cincinnati.
M.S., 1903, Columbian University.

Hiram Colver McNeil, Ohio.
B.S., 1896; M.S., 1899, Denison University.

Henry Albert Pressey, Maine.
B.S., 1893, Columbian University.
B.S., 1896, Massachusetts Institute of Technology.

Master of Arts.

Alice Marie Clark, District of Columbia.
A.B., 1896, Woman's College of Baltimore.

Ella Arvilla Merritt, Minnesota.
A.B., 1903, Columbian University.

Paul Noble Peck, District of Columbia.
A.B., 1904, Columbian University.

Master of Science.

Cyrus Day Backus, New York.
Ph.B., 1896; LL.B., 1896, Cornell University.
B.S., 1904, Columbian University.

William Cornelius Gerdsen, Minnesota.
B.S., 1898, University of Minnesota.

Millard Caleb Marsh, New York.
B.S., 1897, Cornell University.

Charles Napoleon Moore, Ohio.
A.B., 1903, University of Cincinnati.

Raymond Outwater, District of Columbia.
B.S., 1904, Columbian University.

Civil Engineer.

William Chester Thom, District of Columbia.
B.S. in C.E., 1904, Columbian University.

Mechanical Engineer.

James Alfred Brearley, Pennsylvania.
B.S., 1903, Columbian University.

George Ellis Kirk, Ohio.
B.S., 1904, Columbian University.

Charles Wilson Rippey, New York.
B.S., 1904, Columbian University.

Bachelor of Arts.

Augusta Moulton De Forest, Kansas.
(With distinction.)

George Emery Green, Massachusetts.
Reymond Fauche Kirkman, Illinois.
Maud Esther McPherson, District of Columbia.
(With distinction.)

William H. Singleton, District of Columbia.
(As of the class of 1875.)

Otto Louis Veerhoff, District of Columbia.
Amy Louise Warn, Kansas.

Bachelor of Science.

Susan Louise Balentine, Ohio.
Walter J. Bennett, Ohio.
Harry Coope, Ohio.
LL.B., 1899; LL.M., 1900, National University.
M. P. L., 1901, Columbian University.

Horace Marion Fulton, District of Columbia.
George Marshall Saegmuller, Virginia.

Bachelor of Science in Chemistry.

Edward Matthews Dawson, Jr., District of Columbia.

Bachelor of Science in Civil Engineering.

Edwin Vivian Dunstan, Virginia.
(With distinction.)

George Foster Harley, Georgia.

Bachelor of Science in Electrical Engineering.

Charles Nichols Gregory, New York.
James Muscoe Matthews, District of Columbia.
Lloyd Lyman Smith, South Dakota.
Charles Roundtree Sugg, North Carolina.
(With distinction.)
Mark Rittenhouse Woodward, District of Columbia.

Bachelor of Science in Mechanical Engineering.

Frederick Wilhelm Albert, Pennsylvania.

Doctor of Medicine.

Frank A. Allen, Minnesota.
Samuel Duffie Austin, Mississippi.
Herschel Edward Baldwin, Illinois.
Rhodric Winfield Browne, Massachusetts.
Zadoc Maurice Brady, Maryland.
Henry Bohlen Bryan, Virginia.
Edward Warren Burch, Maryland.
Daniel P. Bush, Nebraska.
George Hildreth Camp, Pennsylvania.
William Whitney Christmas, North Carolina.
Wayne F. Cowan, Wisconsin.
Raymond Adams Fisher, District of Columbia.
Thomas Madden Foley, District of Columbia.
Edmund T. M. Franklin, Virginia.
William Joseph French, Minnesota.
Earl Bruce Graham, New York.
Edward James Gunning, Pennsylvania.
Tharos Harlan, Maryland.
Frederick Mason Hart, New York.
Frank Crawford Hayes, Illinois.
Samuel Carle Henning, North Dakota.
Ross Joseph Hillegass, Pennsylvania.
Josiah Hutton Holland, District of Columbia.
Phar.D., 1901, National College of Pharmacy.
Armen G. Hovsepian, District of Columbia.
William Burrows Hudson, Connecticut.
Arthur Leroy Hunt, Maine.
A.B., 1898, Bowdoin College.
Frank Hubert Jett, Indiana.
Flavius Thomas Johnson, Michigan.
Glenn Irvine Jones, District of Columbia.

Adam Kemble, Pennsylvania.
Emil Krulish, Iowa.
Frederick W. Kuehn, Indiana.
Archibald Cary Lewis, Virginia.
William H. Littlepage, Arkansas.
James Mortimer Lynch, Texas.
Frank Leslie Martine, New Jersey.
Arthur Nourse Meloy, Maryland.
Joseph Alexander Murphy, District of Columbia.
Elmer Slayton Newton, Massachusetts.
B.A., 1895, Amherst College.
Alfred C. Norcross, Pennsylvania.
Edward Lee Osborne, Georgia.
Charles A. Pfender, Texas.
James Thomas Prevatt, Georgia.
Thomas W. Raison, Kentucky.
Ausey Hamilton Robnett, Texas.
Willis Parrish Rogers, Nebraska.
Edward Whitmore Sawyer, Massachusetts.
George James Sells, Tennessee.
William Edward Shea, Idaho.
Lucien Conway Smith, Virginia.
Edgar Speiden, Jr., District of Columbia.
Gordon Stanton, South Carolina.
George W. Stiles, Jr., Oklahoma.
B.S., 1900, Oklahoma Agricultural and Mechanical College.
John Allan Talbott, Jr., Maryland.
Walter Gordon Trow, District of Columbia.
Charles Lewis Waters, Maryland.
Marcus Henry Watters, Vermont.
Richard Thomas West, Maryland.
Ph.B., 1897, Dickinson College.
John James Wharton, Maryland.
Lawrence Luther Whitney, New York.
Walter W. Wilkinson, Virginia.

Doctor of Dental Surgery.

Charles De Warren Ake, Pennsylvania.
Lewis Miller Bartlett, Massachusetts.
Adelbert Maurice Bassford, Illinois.
Mark Carleton Bullis, Michigan.
William Earle Butler, West Virginia.
George Samuel Catts, District of Columbia.
Thomas Maslin Chunn, North Carolina.

Seth Eugene Cole, Vermont.
Claude Bonifant Cooksey, District of Columbia.
Angel Custodio Cortes, Porto Rico.
Ralph Webster De Mass, Michigan.
George Andrew Fletcher, New York.
William Edwin Francis, District of Columbia.
Robert Wellington Lowe, Massachusetts.
Fred De Witt Maphis, Virginia.
Leighton Van Buren Marschalk, Florida.
Fred Arthur Mitchell, Texas.
Charles Brown Noble, District of Columbia.
Joseph Wood Pollock, Indiana.
Walter Edwin Rogers, Texas.
John C. R. Schumacher, Missouri.
Thomas R. Wilkerson, Virginia.
Joseph Henry Wood, District of Columbia.

Doctor of Civil Law.

Frederick Carlos Bryan, Ohio.
A.B., 1878, Western Reserve University.
LL.B., 1881, Cincinnati Law School.
LL.M., 1903; M.Dip., 1904, Columbian University.

James Hervey Dorman, Kentucky.
LL.B., 1895, Center College.
LL.M., 1903; M.Dip., 1904, Columbian University.

Haskell Burlason Talley, Tennessee.
LL.B., 1899, Vanderbilt University.
LL.M., 1902, Columbian University.

Master of Diplomacy.

Clarence Crittenden Calhoun, Kentucky.
A. & M. College of Kentucky.

Adolph James Heimbeck, Iowa.
LL.B., 1901, State University of Iowa.
LL.M., 1902, Illinois College of Law.

Paca Oberlin, Virginia.
LL.B., 1903; LL.M., 1904, Columbian University.

Howard Saxton, Nebraska.
LL.B., 1901, University of Nebraska.
LL.M., 1904, Columbian University.

Master of Laws.

Fred Hodges Benson, New York.
L.L.B., 1904, Columbian University.

Samuel Martin Brosius, District of Columbia.
L.L.B., 1904, Columbian University.

Winfield Scott Caldwell, New York.

Walter C. English, District of Columbia.
LL.B., 1903, Columbian University.

Richard W. Flournoy, Maryland.
L.L.B., 1904, Columbian University.

Harriet Freebey, Michigan.
LL.B., 1904, University of Michigan.

Paul Delevan Frost, Iowa.
L.L.B., 1904, Columbian University.

Andrew Jordan Green, Virginia.
LL.B., 1887, National University.
LL.B., 1888; LL.M., 1889, Georgetown University.

Henry Gulliksen, North Dakota.
L.L.B., 1904, Columbian University.

Nathaniel Harris, Texas.
A.B., 1900; A.M., 1901, Baylor University.
M.A., 1902, Yale University.
L L.B., 1904, Columbian University.

W. Bennett Henderson, Kentucky.
A.B., 1891, Princeton Collegiate Institute.
LL.B., 1892, Cumberland University, Lebanon, Tennessee.

August E. Kuehne, Minnesota.
LL.B., University of Minnesota.

Charles Bryce Logan, Missouri.
LL.B., 1903, Kansas City School of Law.

Leonard Atkins Merritt, Minnesota.
L.L.B., 1904, Columbian University.

Clarence A. Miller, Missouri.
B.L., 1899, Kansas City School of Law.

William Perry Montgomery, Missouri.
LL.B., 1902; LL.M., 1903, National University Law School.

J. Clarke Swayze, Kansas.
A.B., 1899; Ph.C., 1899; A.M., 1900; LL.B., 1902, Kansas University.

Fumihiko Taniguchi, Japan.
LL.B., 1902, Chicago School of Law.

William Julius Wesseler, Missouri.
A.B., 1900, Washington University.
LL.B., 1902, St. Louis Law School.

Master of Patent Law.

Robert W. Burroughs, New York.
A.B., 1900, Colgate University.
LL.B., 1903, Brooklyn Law School.

Leonard Day, Massachusetts.
S.B., 1902, Worcester Polytechnic Institute.
LL.B., 1905, The George Washington University.

Wilbur Fisk Drown, Louisiana.
B.S., 1886, Ohio Northern University.
LL.B., 1902; LL.M., 1903, National University.

Walter Marshall Fuller, Massachusetts.
B.S., 1896, M.S., 1899, Worcester Polytechnic Institute.
LL.B., 1904, Georgetown University.

Owen Henry Fowler, District of Columbia.
LL.B., 1898, Columbian University.

Jesse E. Holliger, Indiana.
B.S., 1899, Rose Polytechnic Institute.
LL.B., 1904, National University.

Benjamin Irving, Oregon.
LL.B., 1904, Columbian University.

Charles McClair, Kansas.
A.B., 1899, University of Kansas.

Langdon Moore, New York.
LL.B., 1905, The George Washington University.

George Bassett Pitts, District of Columbia.
LL.B., 1904, Georgetown University.

Alfred Waters Proctor, Massachusetts.
LL.B., 1901, Columbian University.

Walter L. Redrow, District of Columbia.
B.S., 1900, Ohio State University.
LL.B., 1904, Georgetown University.

Joseph Courtney Stack, District of Columbia.
LL.B., 1904, Georgetown University.

Waitstill H. Swenarton, New Jersey.
Ph.B., 1900, Yale University.
LL.B., 1904, National University.

Edwin Everett Vrooman, Maryland.
LL.B., 1903; LL.M., 1904, National University.

William I. Wyman, Massachusetts.
B.S., 1900, Massachusetts Institute of Technology.
LL.B., 1904, National University.

Bachelor of Laws.

George Price Alderson, West Virginia.

Julius Lyman Baldwin, New York.
A.B., 1901, Princeton.

Jesse William Barrett, Missouri.
A.B., 1901; LL.B., 1902, Christian University.

James William Beller, West Virginia.

Leonie Bone, Illinois.

Charles Hamilton Bradley, District of Columbia.

Thomas Chiles Bradley, South Carolina.
A.B., 1902, Princeton University.

Philip Buettner, Wisconsin.
John M. Burkett, Indiana.
Enoch Aquila Chase, Kansas.
Paul Maltby Clark, Colorado.
Charles Orlando Cole, Oklahoma.
Judson Thomas Cull, District of Columbia.
Silas Henry Cutting, Michigan.
Arthur L. Dahl, Kansas.
Leonard Day, Massachusetts.
B.S., 1902, Worcester Polytechnic Institute.
Samuel Edelstein, Wisconsin.
William Bascom Ellison, Tennessee.
A.B., 1900, Grant University.
Otho Leonard Ferris, Iowa.
Carlton Fox, New Jersey.
Eugene Leage Gaddess, Virginia.
James R. Gaskill, Jr., North Carolina.
Otis Haskell Gates, Florida.
Mark Goode, Illinois.
Richard Magness Graham, Oregon.
J. Morris Graves, Missouri.
John William Gregg, Virginia.
John A. Griesbauer, Jr., District of Columbia.
Mortimer Beecher Hall, Maryland.
B.A., 1896, Columbian University.
Harvey Earlton Hanes, Virginia.
Alvin Dolph Hathaway, Kentucky.
Carl John Hellerstedt, Tennessee.
Herbert C. Hengstler, Ohio.
Frederick R. Hertford, District of Columbia.
Birdette P. Hickox, Michigan.
Ralph Warren Hills, Ohio.
B.S., 1897, Columbian University.
Philip Rea Hindman, Pennsylvania.
Michael Joseph Holland, Massachusetts.
Thomas Salisbury Huff, New York.
Walter Clarence Hurd, Utah.
George A. Hutchinson, Maryland.
Robert Whitney Imbrie, District of Columbia.
Charles Grant James, Ohio.
Walter Slicer Johnson, Washington.
Albert Hearl Keller, Iowa.
Gilbert Walker Kelly, District of Columbia.
Guy Edward Kelly, South Dakota.
John W. Keener, Tennessee.

John Wellington Knowlton, Massachusetts.
A.B., 1897, Tufts College.

John Augustus Lee, Washington.
A.B., 1891, Pacific University.

Irwin Heffenstein Linton, District of Columbia.
Clarence Leroy Marine, Nebraska.
A. George Maul, Ohio.
Alexander H. McCormick, Jr., Virginia.
John Patrick McMahon, District of Columbia.
Langdon Moore, New York.
Howard Moore Morse, Massachusetts.
S.B., 1902, Worcester Polytechnic Institute.

Edmund Quincy Moses, Massachusetts.
B.S., 1902, Harvard University.

Thomas Cebern Musgrave, Texas.
Clarence Raymond Naff, Kansas.
Horace Strait Naylor, District of Columbia.
Edwin Jonathan Newmyer, Missouri.
Luther Bertram Nye, District of Columbia.
Irvin St. Clare Pepper, Iowa.
Joseph H. Peterson, Idaho.
Robert Baxter Pharr, North Carolina.
A.B., 1901, Erskine College.

Richard Granville Povey, Connecticut.
B.S., 1901, Wesleyan University.

William Keyes Quinter, District of Columbia.
James Bickle Rickard, Hawaii.
Fred Burnett Rhodes, Maryland.
Joseph Sagmeister, Ohio.
George Bigelow Schley, Ohio.
B.Sc., 1902; A.M., 1903, Kenyon College.

Edwin Francis Samuels, Massachusetts.
B.S., 1899, Massachusetts Institute of Technology.

William Daniel Searle, New York.
Charles Henry Shaffer, Maryland.
S.B., 1896, St. John's College.

Arthur Veeder Snell, New York.
B.L., 1899, Hobart College.
Ph.B., 1900, University of Chicago.

William John Sperl, Massachusetts.
B.S., 1894, W. P. I.

Edgar Spinks, Mississippi.
Delmar Clay Stutler, West Virginia.
B.S., 1894, W. P. I.

Julius Arthur Tellier, Vermont.
A. B., 1902, University of Vermont.

William Pressley Webb, Virginia.
George Langdon Whitford, New Hampshire.
Hugh Williams, Jr., New York.
Orin Hazen Woods, Wyoming.
Herbert Alpheus Wrenn, Virginia.
Eugene Young, District of Columbia.

Degrees Conferred at Winter Convocation, 1906.

IN COURSE.

Master of Science.

Evelyn Groesbeeck Mitchell, New York.
B.A., 1902, Cornell University.
Thesis: Keys to the Adults, Pupæ, Larvæ, Eggs of the North American Mosquitoes.

Bachelor of Science in Architecture.

William Henry Irwin Fleming, District of Columbia.
Delos Hamilton Smith, District of Columbia.

Bachelor of Laws.

John Sherman Biggs, Kansas.
LL.B., 1901, Kansas City School of Law.
Frederick Transom, Pennsylvania.
B.S. in M.E., 1895, University of Pennsylvania.
William Franklin Waite, Alabama.
David Whitcomb, New York.
B.A., 1900, M.A., 1905, Amherst College.

Master of Patent Law.

George Ellis Kirk, Ohio.
B.S., 1904; M.E., 1905, The George Washington University.

Doctor of Medicine.

Philip Eugene Garrison, New Jersey.
A.B., 1900, Wesleyan University.
James Edward Haggerty, New York.
Benjamin Hallowell Swain, North Carolina.

Master of Diplomacy.

Winfield Scott Caldwell, New York.
LL.M., 1905, The George Washington University.

Doctors of Philosophy.

During the years 1894 to 1905, inclusive, the University has conferred the degree of Doctor of Philosophy, after examination and the presentation and public defense of a thesis, upon the following persons:

1894.

Edward Farquhar, (Greek)
Thesis: Elements of Unity in the Homeric Poems. (Conservative Review, vol. iii, June-September, 1900.)

Walter Scott Harshman, (Theoretical Astronomy)
M.S., 1892, Columbian University.
Thesis: Investigation of the Motion of the Pericentre of Deimos. (Astronomical Journal, Boston, vol. xiv, pp. 145-148, 1894.)

Professor Frank Hall Knowlton, (Botany)
B.S., 1884; M.S., 1887, Middlebury.
Thesis: The Flora of the Laramie Group and Allied Formations. (Not published.)

Claude Augustus Oscar Rosell, (Chemistry)
M.A., 1881, University of Pennsylvania; LL.B., 1886, Georgetown University.
Thesis: Investigation of the Properties of Ferric Acid. (J. Am. Chem. Soc., vol. xvii, pp. 760-769, 1895.)

1895.

George Wesley Hamner, (History)
B.A., 1882; M.A., Hiawassee College; LL.B., 1885, University of Alabama; LL.M., 1886, Georgetown University.
Thesis: Researches upon the Government of the Creek Indians. (Not published.)

1896.

Edward Clarke Hudson, (Greek)
B.A., 1884; M.A., 1894, Hiawassee College; M.A., 1894, Columbian University.
Thesis: Investigation into the Use of the Genitive Case in Greek. (Not published.)

Rev. James Stephen Lemon, (Psycho-physics)
B.A., 1864; M.A., 1867, Wesleyan University, Middletown, Conn.
Thesis: The Skin Considered as an Organ of Sensation. (Published separately, 1898, 70 pp.)

1897.

Professor Charles Arthur Hollick, (Palæobotany)
Ph.D., 1879, Columbia College.
Thesis: Palæobotany of the Yellow Gravel at Bridgeton, N. J. (Not published.)

John Scott Johnson, (Philosophy)

B.S., 1893; M.A., 1894, Columbian University.

Thesis: The Influence of French Thought on the Formation of the Constitution of the United States. (Not published.)

Timothy William Stanton, (Palæontology)

B.S., 1883; M.S., 1895, University of Colorado.

Thesis: A Comparative Study of the Lower Cretaceous Formations and Faunas of the United States. (Jour. of Geology, pp. 1-49, September-October, 1897.)

1898.

Cabell Whitehead, (Chemistry)

B.M., 1885, Lehigh University; M.S., 1895, Columbian University.

Thesis: A Study of the Tellurides; Their Formation and Chemical Properties. (Not published.)

1900.

Eugene Byrnes, (Physical Chemistry)

B.A., 1884, Michigan University; LL.B., 1887; LL.M., 1888, Columbian University.

Thesis: Experiments on the Direct Conversion of the Energy of Carbon into Electrical Energy. (Not published.)

Rev. Benjamin Alfred Dumm, (Philosophy)

B.A., 1886; M.A., 1889, Western Maryland College.

Thesis: The Concept of Self in the Analysis of Experience. (Not published.)

Professor Charles Russell Ely, (Chemistry)

A.B., 1891; A.M., 1897, Yale College.

Thesis: Investigation of the Phenomenon of Deliquescence and the Capacity of Salts to Attract Water Vapor. (Not published.)

Ernestine Fireman, (Chemistry)

M.S., 1898, Columbian University.

Thesis: The Action of Phosphonium Iodide on Tetra and Penta Chlorides. (Am. Chem. Jour., 30, 116-133, 1903.)

Charles Moore, (American History)

A.B., 1878, Harvard; M.A., 1898, Columbian University.

Thesis: The Northwest under Three Flags. (Published separately by Harper & Bros., New York, 1900, 402 pp.)

1901.

William Hamilton, (American History)

B.A., 1891, Moravian College, Pennsylvania; M.A., 1894, Columbian University.

Thesis: The Expansion of Russia to the Eastward. (Not published.)

Chohei Shirasu, (Economics)

Graduate, 1893, Doshisha University, Japan; A.M., 1899, Yale University.

Thesis: The Development of Commerce in Japan and its Effect on Civilization. (Summary of Commerce and Finance for December, 1901, Bureau of Statistics, U. S. Treasury Department, pages 2227-2315.)

1902.

Rev. Frank Leighton Day, (Anthropology)

B.A., 1891; M.A., 1896, Roanoke College; B.D., 1895, Vanderbilt University.)

Thesis: Did the Semites Pass through a Totem Stage? (Not published.)

Nevil Monroe Hopkins, (Chemistry)

B.S., 1899; M.S., 1900, Columbian University.

Thesis: Some Experiments on Electrolytic Conductivity with Reference to the Ionic Theory. G. W. U. Bull., 3 [3], 91-94, 1904. (Published separately as "Experimental Electro-Chemistry," by D. Van Nostrand Company, New York, 1905, 284 pp., 131 ill.)

1903.

Edwin Allston Hill, (Chemistry)

A.B., 1875; A.M., 1902, Yale University; M.S., 1901, Columbian University.

Thesis: The Constitution of Certain Halogen Oxy-acids as inferred from Thermo-Chemical Data. G. W. U. Bull., 3 [4], 94-103, 1904.

William Mather Lamson, (Architecture)

B.S., 1897; C.E., 1899, Columbian University.

Thesis: Iron and Steel Domes. (Not published.)

Thomas Malcolm Price, (Biochemistry)

B.S., Maryland Agricultural College; M.S., 1900, Columbian University.

Thesis: The Influence of Varying Strength Solutions of Formaldehyde on some of the Enzymes of Animal Origin. G. W. U. Bull., 3 [4], 104-108, 1904.

Harriet Richardson, (Zoology)

A.B., 1896; A.M., 1901, Vassar College.

Thesis: Contributions to the Natural History of the Isopoda. (Proc. U. S. Nat. Museum, 27, 1-89, 1904, and Bull. U. S. Fish Com., pp. 47-54, Sept. 17, 1903.)

1904.

William Macon Coleman, (History)

A.B., 1858; A.M., 1892, University of North Carolina.

Thesis: A Refutation of Mommsen's Theory on Cæsar's Agrarian Policy. (Not published.)

Frank Van Vleck, (Mechanical Engineering)

M.E., 1884, Stevens' Institute of Technology.

Thesis: Improvements in Ship Construction. (Not published.)

Andrew Wilson (American History)

B.S., 1885; B.O., 1886; B.A., 1886; M.A., 1890, Kansas Normal College; LL.B., 1890; LL.M., 1891, Georgetown University; M.L., 1892; D.C.L., 1893, Yale University.

Thesis: Influence of John Marshall on the Political History of the United States. (Not published.)

1905.

Ray Smith Bassler, (Paleontology)

B.A., 1902, University of Cincinnati; M.S., 1903, The Columbian University.

Thesis: A Study of the James Types of Ordovician and Silurian Bryozoa. (Not published.)

Hiram Colver McNeil, (Chemistry)

B.S., 1896; M.S., 1899, Denison University.

Thesis: On the Constitution of Certain Natural Silicates. G. W. U. Bull., 4, [3], 76-79, 1905.

Henry Albert Pressey, (Hydraulic Engineering)

B.S., 1893, The Columbian University; B.S., 1896, Massachusetts Institute of Technology.

Thesis: Flow of Water in Channels. (Not published.)

Warren Waverley Phelan, (Comparative Jurisprudence)

B.A., 1894; M.A., 1896, Columbia University.

Thesis: An Historical Sketch of the Criminal Law of Louisiana from the Founding of the Colony to the Establishment of the State. (Not published.)

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OF

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The letter in brackets following the name indicates to what department of the University the officer belongs: G. S., Graduate Studies; C. C., Columbian College; W. C. E., Washington College of Engineering; Arch., Division of Architecture; M, Medicine; D, Dentistry; L, Law and Jurisprudence; P, Politics and Diplomacy; H, Hospital; Phar., Pharmacy. The number indicates the page of the Catalogue on which may be found the full name, degrees and titles.

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THOMPSON, J. F. [M, 139] The Edward, 15th St
THOMPSON, J. L. [M, 141] University Hosp.
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TRIVETT, A. M. [D, 171] 1238 G St., N. E.
VANCE, W. R. [*Dean*, L, 185] The Cumberland
VAN RENSSELAER, J. [M, 139] The Rochambeau
VAN VLECK, F. [G. S., 32; W. C. E., 59] 1837 M St
VEDITZ, C. W. A. [G. S., 32; C. C., 38; W. C. E., 59; P, 204] 1333 Harvard St
VEERHOFF, O. L. [C. C., 39] 1436 Park St
WAGGAMAN, S. [*Trustee*, Phar., 15; Phar., 214] 1409 31st St
WALCOTT, C. D. [*Trustee*, Corp., 14] 2117 S St
WALTON, J. R. [D, 170] 218 2nd St., N. E.
WELLER, F. P. [*Trustee*, Phar., 15] 753 8th St., S. E.
WELLINGTON, J. R. [M, 140] 1706 Rhode Island Ave
WHITE, C. S. [M, 140] Emergency Hosp.
WHITE, W. A. [M, 140] Government Hosp. for Insane
WILBUR, W. A. [G. S., 31; *Dean*, C. C., 38; W. C. E., 59; Arch., 70] 1815 Riggs Pl
WILEY, H. W. [G. S., 32] 1314 10th St
WILKERSON, T. R. [D, 171] 428 M St
WILLIS, H. P. [C. C., 38; P, 204] The Kensington
WILSON, J. M. [*Trustee*, W. C. E., 15] 1773 Mass. Ave
WOLFE, A. S. [D, 21] 1115 G St
WOLFF, F. A. [G. S., 32] 1429 R St
WOODWARD, S. W. [*Trustee*, Corp., 14; C. C., 15] 2015 Wyoming Ave
WOODWARD, W. C. [M, 139] 508 I St
WOODWARD, S. M. [W. C. E., 59] Dep't of Agriculture
WRIGHT, C. D. [P, 204] Clark Coll., Worcester, Mass.
YARROW, H. C. [*Trustee*, Corp., 14; M, 139] 814 17th St

GEOGRAPHICAL DISTRIBUTION OF STUDENTS.

United States.	Grad.	Coll.	Eng.	Arch.	Teach.	Med.	Dent.	L. & J.	P. & D.	Phar.	Total.
Alabama	...	2	....	...	...	1	...	6	...	...	9
Arizona	2	....	....	2	...	....	...	....	...	...	4
Arkansas	...	2	1	...	...	....	...	4	...	1	8
California	1	2	1	...	...	3	...	8	1	...	16
Colorado	...	3	1	...	...	2	...	8	...	1	15
Connecticut	2	1	1	1	...	5	2	3	...	...	15
Delaware	...	....	....	...	...	....	...	1	...	1	2
District of Columbia	18	109	53	16	88	50	8	98	3	28	471
Florida	1	1	....	1	...	2	...	3	...	...	8
Georgia	1	3	1	...	...	3	1	4	1	1	15
Idaho	...	1	....	...	...	...	...	....	...	...	1
Illinois	1	14	4	...	1	10	1	21	...	5	57
Indian Territory	...	1	...	...	...	....	...	1	...	...	2
Indiana	1	5	1	...	...	6	1	8	1	...	23
Iowa	2	5	1	1	...	3	...	15	1	...	28
Kansas	1	1	1	...	...	2	2	8	...	...	15
Kentucky	...	2	3	...	...	5	1	12	...	...	23
Louisiana	...	....	...	...	...	6	...	3	...	...	9
Maine	...	1	....	2	...	3	...	2	...	...	8
Maryland	11	16	14	5	2	17	5	27	1	8	106
Massachusetts	3	5	....	...	...	5	1	23	1	...	38
Michigan	...	7	1	...	...	5	1	13	...	...	27
Minnesota	1	5	2	...	...	2	...	5	2	1	18
Mississippi	1	1	....	...	...	3	...	9	...	...	14
Missouri	1	2	1	...	...	6	4	7	3	...	24
Montana	...	....	....	...	...	...	1	2	...	..	3
Nebraska	...	2	2	...	...	3	1	4	3	...	15
New Hampshire	1	2	1	...	...	2	...	7	...	...	13
New Jersey	1	4	2	...	...	7	1	10	...	2	27
New York	6	19	11	2	...	20	6	39	2	3	108
North Carolina	1	3	2	...	...	16	...	7	...	1	30
North Dakota	...	1	...	...	1	1	...	....	...	...	3
Ohio	2	7	2	1	1	7	2	27	...	3	52
Oklahoma Territory	2	2	....	...	...	3	...	1	...	3	11
Oregon	...	1	....	...	...	1	...	1	...	...	3
Pennsylvania	6	16	11	2	...	22	4	30	2	...	93
Rhode Island	...	2	1	...	...	....	1	....	...	...	4
South Carolina	...	2	2	...	...	4	...	5	...	1	14
South Dakota	...	3	2	...	...	1	1	4	1	...	12
Tennessee	3	3	....	...	..	2	1	9	...	...	18
Texas	2	7	....	...	...	6	...	8	...	1	24
Utah	...	2	....	...	...	5	1	4	...	...	12
Vermont	1	2	...	...	...	1	1	3	...	...	8
Virginia	6	20	10	2	...	28	5	30	4	8	113
Washington	1	....	....	...	...	....	...	7	...	...	8
West Virginia	...	4	1	...	...	4	4	9	...	...	22
Wisconsin	1	6	....	1	...	3	3	12	...	...	26
Wyoming	...	....	2	...	...	...	...	1	...	...	3
Total United States	80	297	135	36	93	275	59	509	26	68	1,578

GEOGRAPHICAL DISTRIBUTION OF STUDENTS—Continued.

Foreign countries.	Grad.	Coll.	Eng.	Arch.	Teach.	Med.	Dent.	L. & J.	P. & D.	Phar.	Total.
Canada	...	...	...	...	...	1	...	...	...	...	1
Chili	...	...	...	...	...	...	...	1	...	...	1
China	...	2	...	...	...	...	...	...	...	...	2
Costa Rica	...	...	...	...	...	1	2	...	...	...	3
England	...	...	...	...	...	...	...	...	...	1	1
Finland	...	...	...	...	...	1	...	...	...	...	1
Germany	2	2	...	...	...	...	...	...	...	2	6
Hawaii	...	...	...	...	...	...	...	3	...	...	3
Hungary	...	...	...	1	...	...	...	...	...	...	1
Korea	...	1	...	...	...	...	...	...	...	...	1
Mexico	...	...	...	...	...	...	...	1	...	...	1
Philippine Islands	...	1	...	...	...	...	...	5	...	...	6
Porto Rico	...	...	...	...	...	1	1	...	...	...	2
Russia	...	...	...	...	...	...	...	...	...	1	1
Turkey	...	...	...	...	...	...	1	...	...	...	1
Uruguay	...	...	...	...	...	1	...	...	...	...	1
Venezuela	...	...	...	...	...	...	...	...	1	...	1
Total foreign countries	2	6	....	1	...	5	4	10	1	4	33
Total United States	80	297	135	36	93	275	59	509	26	68	1,578
Grand total	82	303	135	37	93	280	63	519	27	72	1,611

RECAPITULATION.

Members of the Faculties and Teaching Staff:	
Professors	89
Assistant Professors	22
Instructors, Demonstrators, and Assistants	71
Lecturers	13
Librarians and Assistants	5
Total	200
Students:	
Graduate	109
Undergraduate	568
Professional	934
Total	1,611
Duplicates	31
Total	1,580

RECAPITULATION (Continued).

	Faculty.		Students.	
Department of Arts and Sciences:				
Faculty of Graduate Studies	37		82	
Columbian College	42		303	
Washington College of Engineering	29		135	
Division of Architecture	25		37	
In attendance upon the Courses for Teachers	8		93	
		141		650
Department of Medicine:				
Faculty of Medicine	79		280	
Faculty of Dentistry	41		63	
		120		343
Department of Law and Jurisprudence		22		519
Department of Politics and Diplomacy (Post-graduate)		22		27
National College of Pharmacy		9		72
		314		1,611
Duplicates		114		31
Totals		200		1,580

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VOL. V. NO. 2.

The George Washington University
(FORMERLY COLUMBIAN)
Bulletin

JUNE, 1906.

ALUMNI NUMBER.

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THE GEORGE WASHINGTON UNIVERSITY

BOARD OF TRUSTEES.

The term of trustees expires, in each case, on Commencement Day of the year indicated.

The George Washington University
BULLETIN

VOL. V. JUNE, 1906. No. 2.

PRESIDENT NEEDHAM TO THE ALUMNI.

I desire to present to the Alumni the greetings of the University, to briefly state the results of the last year's work, and the needs and the aims of the University.

Our reorganization has been successfully completed and we are already beginning the new growth. The University is non-sectarian in its organization and work. It is composed of Departments, under the immediate direction and support of the University Board, in which post-graduate work and professional education is carried on. This constitutes the whole of the educational work which the Board of Trustees of the University is conducting. The Colleges already organized are the Columbian College, an arts and science undergraduate College; the College of Engineering, with complete undergraduate courses in civil, mechanical and electrical engineering; and the College of Pharmacy, also an undergraduate college. These Colleges are educationally a part of the University but each has its separate Board of Trustees and is upon an independent financial basis. The Colleges have passed a very successful year. Columbian College has registered 303 students, the College of Engineering 135; the Division of Architecture 37; the College of Pharmacy 72. In the Departments of the University the attendance has been equally encouraging. In the Department of Medicine 280 have registered; in the Department of Dentistry 63; Department of Law and Jurisprudence 519; Department of Politics and Diplomacy 27; in Graduate Studies 82; in Teachers' Courses 93; making a total registration last year of 1,580. The Faculties number 200.

While we rejoice in the large increase in numbers we are more deeply gratified by the development of the University and academic spirit. These Departments and Colleges are being bound together into one common life and we begin to feel the pulsation of that institutional life which is greater than any part or Department can possibly be. "A university," it has been said, "is not so much a place where all that is known is taught, as a place where noble and luminous minds create an atmosphere which it is impossible to breathe and not feel the quickening of new and larger hopes and aims—minds that are less concerned to impart information about things than to solicit, call forth, sustain and strengthen and bring into action the powers which lie latent in the human soul; striving themselves day by day to become wiser and more loving, that with

each access of new life they may thrill, inspire and impel others to generous and persevering self-activity."

We are striving for this community life and hope that upon the new site now already paid for we may soon begin building and that the Alumni will soon complete the contributions necessary for Alumni Hall, which is to be the centre of the social life of the University.

All will agree, I am sure, that it is essential that we should strive for the best and largest student body possible for the University as a whole, and that the University should become the peer of the best institutions in this country. To do this we have been compelled to consider whether the courses of study and class-room hours should be, in the future as in the past, arranged primarily for those students in Government employ, who can devote only part of the day to the University, or, whether, the arrangement should be primarily for full day students, giving to the former full opportunity to carry on work in any Department or College of the University, but requiring of them a longer period of time in which to earn a degree. The quality of the students that the University has had from the Departments of the Government has been of a high order. They are serious-minded, well equipped young men, but the number is necessarily limited, and if the University is to grow it must appeal to a wider field and a larger number of prospective students. If the courses of study are arranged primarily for afternoon work the full day men will not come to us in any great numbers. To secure the full day students there must be class-room work going on throughout the day as in other institutions. After very thoughtful and careful consideration it was determined to take all the work out of the evening hours, closing the class room work at six-thirty, and to arrange the courses in all the Departments for full day work, beginning at eight and nine o'clock in the morning. To do this involved an increase in the number of professors and instructors giving their whole time to the University. Thus in Arts and Sciences we have already added fifteen men of this type to the Faculty; we shall have next year in the Department of Medicine four, and in the Departments of Law and Jurisprudence and Politics and Diplomacy five, teachers, giving their full time to the work.

We have also changed the method of teaching, especially in the professional schools. The student is brought face to face with the facts to be learned. In the Medical School clinical teaching has been largely increased, taking the place of didactic lectures. In the Law School the study of cases has been substituted. We seek to make men find knowledge for themselves and learn to use their intellectual faculties in applying the knowledge thus obtained to actual cases. This requires a higher standard of preparation for the work, and by an Ordinance adopted by the Trustees, at least two years college work will be required after 1908 for admission to the Department of Medicine, and to the Department of Law and Jurisprudence. In the Department of Politics and Diplomacy we already require a college degree or its equivalent.

The standard of work in the post-graduate courses is excellent and

the number already enrolled for higher degrees is very gratifying. The graduate Department of Arts and Sciences is to be the crown of the new University system, but before we can realize the high ideals aimed at in this Department we must have a $2,000,000 endowment devoted to instruction, laboratories and seminary equipment.

We are in great need of a new building for the Department of Politics and Diplomacy, and an endowment to enable us to secure an able Dean and coadjutors for this work. President James, of the University of Illinois, writing upon the subject of "a great educational institution in the city of Washington," namely, a School of Politics and Diplomacy, says:

"Here is the natural place for such a centre of scientific investigation. Here is the place where men interested in this department of our racial life most congregate. Here is the only centre of diplomatic influence and power in the country. Here are the ablest statesmen; here are the greatest courts. * * * * * * * * * A great school of this kind would prepare men for the public service as at present no men are prepared in the United States. The existence of such a school and the preparation which its graduates would have, would call the attention of the federal administration to the fact that it could obtain competent men for any administrative position within its gift, and the supply of men for such training would create a demand for their services."

I desire also to call the attention of our Alumni to the need of a new building for the Department of Law and Jurisprudence. Already we have outgrown the present accommodations. We have the ground and are pressingly in need of money for the building. If an Alumnus has the money and desires fame let me commend to him the building of a Hall, to be named after him, upon Seventeenth Street just below the State Department, that shall house the Law and Jurisprudence School of this University.

But especially I appeal to you to have an active interest in the plans of the officers of the General Alumni Association, who are now raising funds for the erection of Alumni Hall. It is desired that every Alumnus may have a share, however small, in this building, so that it may be an abiding testimonial to the patriotism and affection of the old students for their Alma Mater.

Institutions of learning are made by the men that compose them, and a very important section of this body is the Alumni—men who have gone out from the institution which has equipped them for life. No institution can prosper largely that does not have the hearty support and coöperation of the great body of its graduates. In these new movements the University makes its appeal to you and asks for your intelligent and hearty support in its new plans and desires you to share in all the honors that come to the University as the result of its new and expanding life.

Charles W. Needham.

The George Washington University,
June 18, 1906.

WHAT THE UNIVERSITY IS DOING.

The University.

The session of 1905-06 has been the most prosperous year in the history of the University. The total enrollment of students is 1,580, representing 48 states and territories, Hawaii, Porto Rico, and the Philippines, and of foreign countries, Canada, Chili, China, Costa Rica, England, Finland, Germany, Hungary, Korea, Mexico, Russia, Turkey, Uruguay, and Venezuela. The total for 1903-04 was 1,408; for 1904-05, 1,456; showing an increase over last session of 124. The student body consists of 109 graduate, 568 undergraduate, and 934 professional students.

The members of the faculties and teaching staff now number 200, being an increase of 30 instructors over the session of 1904-05. In October, 1905, the National College of Pharmacy was affiliated with the University under the Act of Congress providing for the incorporation of colleges under the University charter.

The University Library has been enriched through the donation of several thousand volumes, in addition to its regular purchases. The Germanic Library of the late Professor Richard Heinzel of the University of Vienna, acquired through the generosity of Mr. Christian Heurich, contains 7,200 volumes and pamphlets bearing on German philology and literature, and a large number of works and periodicals in the cognate branches, notably Anglo-Saxon, Old English, Slavic and the Romance languages. Mrs. John Hay has presented to the Department of Politics and Diplomacy a choice collection of books from the library of the late Secretary of State. Professor J. Ford Thompson, M.D., has presented to the Medical Department his valuable library of books on surgery. The work of classifying and cataloguing the contents of the various libraries has been successfully carried on by the librarian and assistants.

The University Bulletins have been regularly issued under the supervision of the Board of University Publications. The Alumni Number, which appeared in June 1905, contained a summary of the work of the University for the session of 1904-05, and an alphabetical list of Alumni arranged (1) by names, and (2) by cities, compiled and edited by Professor H. L. Hodgkins, Secretary of the General Alumni Association. The October scientific number contained important papers by members of the faculties, abstracts of Ph.D. theses, a supplement to the Bibliographical Record of 1904, notices of works published by professors, University appointments and miscellaneous items. The December number was devoted to the Department of Politics and Diplomacy, containing a series of papers by members of this Faculty, and notices of their scientific contributions. The Board has begun the publication in series of studies in (1) philosophy, (2) philology and literature, (3) pure science, (4) politics and diplomacy, (5) law and jurisprudence. The University Catalogue appeared in March, 1905, together with separate

announcements of the Departments of Arts and Sciences, Medicine, Dentistry, Law, and Politics and Diplomacy. The October issue of the Bulletin is, by vote of the President's Council, to be devoted to the interests of the Department of Medicine, and the December number to the Faculty of Graduate Studies. The University publications are sent to 234 American universities and colleges, and 90 foreign universities, and the list of exchanges already received, embraces 45 American and 20 foreign scientific periodicals, in addition to catalogues and circulars.

During the session Teachers' Courses were offered to the public school teachers of Washington, as follows: Aesthetics by Professor Raymond, Architecture by Professor Ash, Classical Archæology by Professor Carroll, Diplomacy by Professor Foster, Economics by Professor Veditz, English by Professor Wilbur, History by Professor Swisher, and Constitutional Law by Justice Harlan.

The courses were chosen from those regularly given at the University which appeared most nearly related to topics treated of in the public school work and which appeared most directly to appeal to the teachers. The attendance of teachers was 15 on Aesthetics, 7 on Archæology, 10 on Architecture, 11 on Diplomacy, 5 on Economics, 18 on English, 17 on History, and 10 on Constitutional Law, there having been 93 teachers in all who availed themselves of this opportunity for work at the University. This was an increase of 27 teachers over the attendance in the year 1904-05, 66 teachers being enrolled for that year.

This scheme has met with the hearty coöperation and approval of the Board of Education and of Mr. Stuart, Superintendent of Schools of the District of Columbia. In fact the selection of those who are to be admitted to the various courses is made by the latter from among the applicants, he having full knowledge of the special needs and qualifications of the candidates. This plan has proved of value to the University by bringing its professors in close contact with the public school system and by giving a considerable number of the teachers an opportunity to view closely the work of the University.

Department of Arts and Sciences.

Faculty of Graduate Studies:—The total number of candidates registered under the Faculty of Graduate Studies for the year 1905-06 was 82; there being 12 candidates for the M. A. degree; 12 candidates for the M. S. degree; 2 candidates for the C. E. degree; 2 candidates for the E. E. degree; 1 candidate for the M. E. degree; 5 students in attendance, and 48 candidates for the Ph.D. degree. Of this number 17 were recommended for graduation: 5 for the M. A. degree; 5 for the M. S. degree; 2 for the C. E. degree; 2 for the E. E. degree; 1 for the M. E. degree, and 2 for the Ph.D. degree. The Doctorate Disputation was held on May 28th, and the two candidates who presented themselves most satisfactorily defended their theses and received the commendation of the Board of Experts. During the year the Faculty has been strengthened by the

addition of Henry L. Abbot, U. S. A., as professor of hydraulic engineering; Edward B. Rosa, Ph.D., as professor of physics; George M. Sternberg, M.D., U. S. A., as professor of preventive medicine; and Frank Leighton Day, Ph.D., as professor of Semitic languages and literature.

As at the last annual commencement we completed twelve years of work, under the present organization, it has seemed wise to make a statistical inquiry into the results and more particularly as they relate to the conferring of the Doctor of Philosophy degree. The results of an examination of the records from 1893 to 1905 are as follows:

Total admissions to all degrees	433
Total degrees of all kinds awarded	242
Per cent of graduates	55.89
Total admissions to candidates for Ph.D	113
Total degrees awarded	31
Per cent of graduates	27.43
Total number of years of work given by candidates admitted to candidature for Ph.D. degree dating from the Masters degree	369
Average for each candidate	2.77
Total number of years of work given by candidates receiving the Ph.D. degree dating from the Master's degree	86
Average for each candidate	2.77

In the cases of ten of these candidates credit was given them on the required work of the course for work pursued and properly certified elsewhere. Adding a year for each of these, we have:

Total number of years of work given by candidates receiving the Ph.D. degree dating from the Master's degree	96
Average for each candidate	3.1
Total number of years elapsed from date of Bachelor's degree to receiving Ph.D. degree	364
Average for each candidate	11.7

Columbian College:—The academic year just closing has been educationally a prosperous year. The graduating class numbers 25—16 Bachelors of Arts, 17 Bachelors of Science, 2 Bachelors of Science in Chemistry. The good student quality that we have to deal with is suggested by the fact that 9 out of the 16 students in the Bachelor of Arts course have for their entire course above 92% of their marks over 90%.

The student registration in Columbian College this year has been

affected by the establishing of the Washington College of Engineering with the segregation of 135 students, and of the Division of Architecture with 37 students. Notwithstanding this setting off of 172 students from Columbian College there is this year a registration of 303. This is but 140 less than last year, showing a net increase of 32 to be accounted for. The fact that there is this year an increase of 18 students in the course for the Bachelor of Arts degree would show that the College has shared largely in the general increase of students.

The additions to the teaching staff of the College have come through the necessities of our long schedule from 9.30 A. M. to 6.30 P. M., through the demand for instruction in subjects new to our curriculum but of fundamental importance, and through the increased burdens of teaching and administration due to the growth of the student body. In addition to the efficient teaching of professors and instructors giving a limited number of hours to the University, there have been added this year the following who have given their entire time: Professor Veditz in Economics, Professor Hough in Philosophy, Dr. Macwhorter in Latin and Greek, Mr. Peck in Mathematics, Mr. Croissant in English, Mr. Keith in Romance Languages. These men have largely increased the amount and efficiency of instruction.

Washington College of Engineering:—The number of enrolled students has been 135, distributed as follows:

	Freshmen.	Sophomore.	Junior.	Senior.	Total.
Civ. Eng.	23	21	12	3	59
Elec. Eng.	15	15	6	2	38
Mech. Eng.	12	11	2	..	25
Special		..	..	..	13
	50	47	20	5	135

The formal organization of the Washington College of Engineering and the appointment of instructors giving their entire time to the University, has made it possible to do the technical engineering work more efficiently than in previous years, when our engineering instructors were present only after half past four o'clock. During the present session in the technical subjects of applied mathematics, graphics, civil engineering, electrical engineering, and mechanical engineering we have given each week a total of 42 hours of class-room work and 29 hours of laboratory and drawing work under direct supervision of instructors, and of these hours, 9 hours of class work and 19 hours of laboratory and drawing work have been given before half-past four.

The work that we plan to give next year shows a considerable increase over that of the present session. This is due partly to the fact that during the present session we did not offer certain advanced courses in electrical and mechanical engineering, which must be given next year; and, more especially, to the fact that in the reorganization of the work

in engineering we have expanded some courses and have very largely increased the hours of drawing, design, and laboratory work, all of which hereafter is to be at assigned hours under the direct guidance and supervision of instructors. Accordingly our weekly schedule for next session for the technical courses calls for 50 hours of class-room work and 73 hours of drawing and laboratory work. This is an increase of 8 hours of class-room work and 44 hours of drawing and laboratory work; of this work 24 hours of class-room and 40 hours of drawing and laboratory work are to be given before half-past four o'clock.

The experience of the present session has shown that there is a call for engineering courses in this city and that this call can be met only by having instructors giving their whole time to the work of the College. Accordingly, the plans for next session provide for the appointment of three instructors, who will displace some instructors who have given but a few hours each week, and who will also be able to take the additional hours called for in our revised schedule.

Necessarily the general subjects—languages, mathematics, physics and chemistry—which are taken in common with the students of Columbian College, will be given in the main building of the University, but we plan, so far as the schedule will permit, to have the engineering subjects given at the Van Ness House. If the increase in instructors that has been recommended be allowed by the Board of Trustees, there will be at least 2 and usually 4 instructors always at that building, and the laboratory and drawing work will be under continual supervision, not only at the assigned hours, but also at all times at which students may desire to work.

Division of Architecture:—The efficiency of the Division of Architecture has been materially increased during the past year by the appointment of Mr. A. B. Bibb, Professor; Mr. Charles Mason Remey, Instructor; and Mr. Hupert P. Illman, assistant. Professor Bibb takes charge of the instruction in the history of architecture, painting and sculpture, giving his entire time to this work. The congestion of former years has been obviated by the Division having use of the entire building, 813 Fifteenth Street, N. W. The attendance during the past year has shown an increase of over 20%, the total number of students registered being 42. The George Washington Architectural Club, a student organization, has been admitted during the past year to membership in the Architectural League of America, as a junior member and was represented at the League Convention held in New York City at the Fine Arts Building in March last. They have also offered three prizes of architectural books, one to each class for the best work in design during the year; also a prize membership in the Washington Architectural Club offered by the Club for the best work in design is annually awarded. The work of the students on the Beaux Art problems has been very successful and the University is to be congratulated on the showing made during the past year. Twenty-three drawings were made and submitted to the Committee in New York in competition with drawings from other

prominent universities and atelier's throughout the country; of these twenty-three drawings one received fourth place and eighteen received mentions, a most creditable record. A minimum period of four years is required for the degree of B. S. in Architecture covering 80 units of work.

Department of Medicine.

Faculty of Medicine:—The total registration was 280 students distributed as follows: First-year class, 62; second-year class, 60; third-year class, 75; fourth-year class, 68; special and review students, 12. The degree of M.D. was conferred upon 49 members of the senior class at the annual commencement. The most noticeable work done during the year was in the increased amount of clinical instruction given in the University Hospital and other hospitals. No other graduating class has gone forth better prepared for the practice of medicine than the class of 1906. Plans are being made to perfect still further the clinical facilities and instruction. The Medical Library has increased considerably by gift and purchase. Professor J. Ford Thompson has presented his valuable surgical library of about 700 volumes, containing many rare works in surgery. Through Mr. Wycoff, the library of the late Dr. L. C. Osmun, class of 1860, was given to the Department, and Dr. H. C. Yarrow has donated regularly periodicals and from time to time a number of valuable works.

A great many hospital appointments have been bestowed during the year on recent graduates. The following Alumni have successfully passed the U. S. Naval Medical Examining Board, and have been commissioned Assistant Surgeons U. S. Navy: Philip E. Garrison, '05; Heber Butts, '04; Thomas W. Raison, '05; A. H. Robnett, '05. Dr. Francis R. Hagner, '94, Clinical Professor of Genito-urinary Diseases, has just been elected Treasurer of the American Urological Association. Dr. J. Ford Thompson, after an active teaching life of more than thirty years as Professor of Surgery, will shortly sail for Europe. Dr. Albert Van der Veer, '62, and LL.D. '04, of Albany, N. Y., has been elected a regent of the University of New York. At an annual meeting of the George Washington University Medical Society which was held May 19, 1906, the retiring President, Dr. A. Barnes Hooe, delivered an interesting address on the history of the Medical Department. The following officers were elected for the ensuing year: John W. Chappell, '81, President; Hanson T. H. Lemon, '96, Vice-President; D. Webster Prentiss, Jr., '99, Secretary; Lewis H. Taylor, '03, Treasurer. A number of valuable papers have been read before the Society. These will appear in the October number of the University Bulletin which will be devoted to the Department of Medicine.

Beginning with the session of 1909-10 no student will be matriculated for the degree of Doctor of Medicine (a) who has not completed satisfactorily in an approved college or scientific institution two years of

work of a regular course for a baccalaureate degree or (b) who does not possess equivalent educational training and requirements.

The Departments of Medicine and of Dentistry, which have been heretofore separate organizations, have been reorganized by the Board of Trustees under one faculty composed of professors, assistant professors and instructors in medicine and of professors and assistant professors in dentistry. There will be a dean of medicine and a dean of dentistry, but the courses of instruction, the University hospital and the dental dispensary will be under the supervision of the one faculty.

Faculty of Dentistry:—There were 23 students in the first-year class, 16 in the second, and 24 in the third, a total of 63. Of these 12 received the degree of D.D.S. on Commencement Day. This was the first session in which the higher entrance requirement, namely, a high school certificate, or its equivalent, was rigidly enforced. The examiner reports that 20% of the students who came before him failed to meet the matriculation conditions. Educationally the session was highly successful, and the lectures and laboratories were well attended. In the Dental Infirmary the instruction proceeded with better results than ever before. The British Examining Board has recently formally recognized the diploma of the Dental Faculty of the University.

College of Pharmacy:—The Faculty of Pharmacy consists of 5 members and 4 assistants; during the coming session the faculty will receive two accessions. The total number of students for 1905-'06 was 74. The number of freshmen advanced to the junior class was 13; the number of juniors advanced to the senior class, 14; the number of senior students who were recommended to receive the degree of Doctor of Pharmacy was 11. The Dean in his annual report to the Trustees of the College of Pharmacy called attention to the standard of admission that was in force in other departments of the University and the necessity for raising the standard of admission to the classes of the College of Pharmacy in order that the College should fully conform with the educational requirements of the University. The trustees have taken up the matter and changes that will meet with the approval of the University will soon be announced.

Department of Law and Jurisprudence.

The total attendance in this department during the past session was 519, of whom 394 were regularly matriculated as undergraduate candidates for the degree of Master of Laws; 34 for Master of Patent Law, and 1 for the degree of Doctor of Jurisprudence; the remainder were special or review students. Of the 115 members of the third-year class who were candidates for the LL.B degree, 87 were graduated. Of the 11 candidates for the LL.M. degree, 5 have been successful; while 19 of the 34 candidates for the M.P.L. degree were graduated. There were also 5 students to receive the degree of Doctor of Civil Law. This gives a total of 114 graduates from this department. Viewed as a whole there

is much in the work done during the past session to encourage us in the belief that a great school of law can be built up in this University. Almost without exception the students have worked faithfully and seriously, and despite the fact that the standard for graduation has been distinctly raised, the number of failures has been gratifyingly small. Many of the professors are now using the case system of teaching law, which has in nearly all instances proved highly acceptable to the students. It is believed that we can without boasting say that in many of our courses the work is now as good as can be had anywhere in this country, and that in our practice work better results are accomplished than in any other school of law.

The most important change that has been made during the past year, to go into effect with the beginning of the next session, is to put a considerable portion of the regular work in the department in the forenoon hours. Nine hours of work each year, however, will be given in the afternoon as heretofore. This will put our law school upon a full day basis and enable us to attract and hold students who are in a position to give their whole time and strength to the study of the law. The subjects given in the forenoon and afternoon will be so alternated as to provide an opportunity for students who are otherwise employed during part of the day to enjoy all the facilities for the thorough study of the law that are given to full day students and permit their graduation after four years. While it is probable that this change will considerably cut down the attendance in the department in the immediate future, it is believed that it will ultimately greatly increase the attendance, the excellence of the work, and the influence of the law school in the educational world.

Another important change, made in response to the general trend in the development of the best law schools in the country, is to require of candidates for a degree two years of college work before beginning their professional training. This provision, however, does not go into effect until the beginning of the session of 1909-10.

The library has been considerably enlarged.

In October 1905, James Brown Scott, A.M., J.U.D., late of Columbia University Department of Law, and Alfred Nerinex, LL.D., Professor Ordinarius of Constitutional Law in the University of Louvain, and Legal Counsellor of the Belgian Legation, were added to the faculty.

Department of Politics and Diplomacy.

The work of this Department during the past session has been entirely post-graduate. There were 22 professors and instructors, and 27 students. 14 required courses and 20 elective courses were given, in addition to the regular work of the seminaries. The instruction was embraced under the general heads of (1) public law; (2) political science; (3) economics and sociology, and (4) history. James Brown Scott, A.M., J.U.D., has

been added to the Faculty as professor of international law and diplomacy, and James C. Monaghan, A.M., lecturer on the consular service, has been appointed professor of commercial economics.

Student Life

Foot Ball:—The striking feature in foot ball at the University last season was not so much the number of games won, as the marked difference between the grade of the teams on that schedule and that of two and three years ago. As rapid as has been the growth in strength of the team, just so rapid has the field of contests widened and the grade of teams that are sought to be placed on the schedule improved. The schedule last year included nine games, those with Gallaudet and St. John's College being victories, with Johns Hopkins and University of Maryland being ties, and those with Swarthmore, University of Virginia, Georgetown, and Washington and Lee being defeats. Manager Wilson has arranged the following strong schedule for next season: October 6, Lehigh; October 13, Gallaudet; October 20, Swarthmore; October 27, Western Maryland; November 3, West Virginia University; November 10, Washington and Lee; November 17, University of Virginia; November 29, Georgetown. B. G. Steenerson served the team excellently as captain and has been honored with the captaincy a second time. R. C. Hellebower made a most efficient manager, arranging a strong schedule and ending the season with the finances in fine shape. One of the best players in the East, Mr. Crowell, captain of Swarthmore's team, has been engaged as coach for next season and everything points to an even more successful year.

Base Ball:—The base ball schedule this season was the strongest that the University has ever attempted, including the Navy, Lehigh, Columbia, Syracuse, Carlisle Indians, Washington and Lee, Georgia, Georgetown, University of Virginia and others. There were strong individuals on the team and at times the team played brilliant ball, notably in its victories over Virginia, Washington and Lee, Georgia and Lehigh, but often there was an evident lack of team work and a disposition to get "rattled" at critical moments. This was due chiefly to the lack of a coach and time to practice. Captain Bradley worked hard and effectively with the material at hand and did all that could be done under the circumstances. While the student attendance at the games was disappointing, yet Manager McEnery succeeded in ending the heaviest schedule ever played by the team in a better condition, financially, than has been done before.

Track:—Track work is the newest form of athletics at the University, last season being the first time that the team has attempted to participate in an intercollegiate contest, but the efforts of the team were very successful. It participated in seven meets and won places in each, the two-mile relay defeating Virginia and the one-mile defeating Johns Hopkins. The Freshman relay defeated a similar team from Georgetown, and Sterrett won in four contests in the pole vault, establishing a record for the

South. Captain Lorando has brought the name of George Washington into prominence in track work by his excellent running in the long distances, having won the mile, half, and two-mile races. The team participated in meets in Philadelphia, Baltimore, Norfolk, and Washington.

The University Rifle Club, organized in April, won two important victories. The Canoe Club has now a permanent camp-site, located at Broadwater, on the Potomac, and has planned for a Club House.

Publications:—The University Hatchet, our weekly newspaper, has been ably edited during the past session by the Editor-in-Chief, Robert I. Moore, and his staff. A corporation has just been formed known as THE UNIVERSITY HATCHET, with a board of directors, consisting of five students and two members of the faculty, who will in the future supervise the publication and insure student control. The Board, appointed for the first year by the President of the University, is as follows: Mr. Moore, Editor-in-Chief; Mr. Russell, Business Manager; Mr. Wilson, Mr. Gates, and Mr. Call, Professor Carroll, and Dean Vance. It is believed that the change from private ownership to student control, will add greatly to the excellence and influence of the paper. The Mall for 1905-06 which appeared in May is a handsome octavo volume in buff and blue, and shows marked improvement over the Mall of 1904-05. Mr. Robert I. Moore was Editor-in-Chief and Mr. E. C. Wilson, Business Manager.

Debating:—During the year two intercollegiate debates have been held, one with the University of Virginia and the other with the University of Cincinnati, in both the decision being unanimous in favor of George Washington. There have been six public inter-society debates among the Columbian, the Needham, and the Enosinian Societies, the Columbian winning from the Needham and one from the Enosinian; the Needham winning two from the Columbian and one from the Enosinian; in the Prize Debate during Commencement the teams were not distinctive. The University Congress has been continued in a prosperous condition during the session and is proving an excellent field for training, in extemporaneous speaking. The University has a remarkable record in intercollegiate debating, having won four debates in succession from the strongest teams without a single defeat, namely: Washington and Lee, Georgetown, the University of Virginia, and the University of Cincinnati.

Y. M. C. A.:—A Young Men's Christian Association has been organized among the students and active work already begun. The membership has grown rapidly and plans have been made to bring it into greater prominence among the students at the opening of next session. President Powers was sent as a delegate to the Students' Volunteer Convention and returned with added enthusiasm for the work of furthering the growth of the Association among the students.

Student Clubs and Societies:—Of clubs and organizations with intellectual aims, the Classical Club has enjoyed the most successful year in its history with 30 active members; it has held regular

meetings at the houses of members and has had two public sessions with lectures by Professor H. L. Wilson of Johns Hopkins University and by Professor J. C. Hoppin, late of Bryn Mawr and the American School at Athens. The Dramatic Club has given two public exhibitions. The Architectural Club has had a series of illustrated lectures at its regular meetings. The Mechanical and Civil Engineering Societies have also had an active year. The Glee Club and the Girls' Glee Club have given frequent entertainments.

The Second Winter Convocation.

The Second Winter Convocation of the University was held in the Belasco Theatre, Wednesday morning, February 22d, at 10.30 o'clock. The University Procession of the president, trustees, faculty and students, in academic caps and gowns, marched from University Hall to the theatre. The address was made by Hon. Leslie M. Shaw, Secretary of the Treasury, on the "Evolution of Self-Government." Degrees were conferred on fourteen candidates as follows: B.S., 2; M.D., 5; LL.D., 4; M.P.L., 1; M.Dip., 1; and M.S., 1. The music was furnished by the Marine Band. After the exercises, a luncheon was served by the Trustees at the Shoreham Hotel to the faculty and invited guests, and in the afternoon a reception in University Hall was tendered to President and Mrs. Needham by the Columbian Women.

The Eighty-Fifth Annual Commencement.

On Sunday afternoon, June 3, the baccalaureate services of the University were held in Memorial Continental Hall. The sermon to the graduating classes was preached by the Rev. Edgar Y. Mullins, D.D., LL.D., President of the Southern Baptist Theological Seminary, Louisville, Kentucky, from the text, "Thou hast put all things in subjection under his feet." (Hebrews 2, 8.)

The University Commencement occurred in the same place the following Wednesday, June 6, at 10.30 o'clock. The University Procession was formed at University Hall, and marched through Lafayette Park down Seventeenth Street to the Memorial Continental Hall. All in the procession, except the candidates for degrees, occupied seats on the platform. The invocation was pronounced by Rev. Samuel H. Greene, D.D., LL.D., Chairman of the Board of Trustees of Columbian College. President Needham then introduced the speaker of the occasion, the Rev. Denis J. Stafford, D.D., Rector of Saint Patrick's Cathedral, Washington, D. C., who delivered the commencement address.

The candidates for degrees were then presented by the Deans of the respective faculties to the President, who granted them their diplomas. There were in all 234 graduates, distributed as follows: B. A., 16; B. S., 7; B. S. in chemistry, 2; B. S. in civil engineering, 3; B. S. in electrical engineering, 2; M. D., 49; D.D.S., 12; Phar. D., 11; LL.B., 87; LL.M., 5;

M. P. L., 19; M. Dip., 1; C. E., 2; E. E., 2; M. E., 1; M. S., 5; M. A., 5; D. C. L., 3; Ph.D., 2. No honorary degrees were conferred. Scholarships and prizes were announced by the Deans. Meetings of the Trustees of the University, of Columbian College, and of the Washington College of Engineering were held in the afternoon. On Wednesday evening a reception at Rauscher's was given by the President and Trustees to the members of the graduating classes.

THE TRUSTEES' AND ALUMNI ANNUAL DINNER.

The most brilliant occasion in the University year was the Annual Dinner of Trustees and Alumni of the University, which occurred at the New Willard Hotel on the evening of March 14. Over 200 Trustees, Alumni, members of the faculty and invited guests were seated at the tables. The ladies of the George Washington Memorial Association and others came in for the coffee and speeches and were seated in the gallery. The banquet hall was decorated with American flags and the colors of the University. The gathering was representative in the large number of leaders in the intellectual and political life of the nation, who were present. The menu card had on its face a cut of the University flag, and on the second page the following legends:

"It has been my ardent wish to see a plan devised, on a liberal scale, which would have a tendency to spread systematic ideas through all parts of this rising empire, thereby to do away with local attachments and state prejudices, as far as the nature of things would, or indeed ought to admit, from our national councils. Looking anxiously forward to the accomplishment of so desirable an object as this is (in my estimation), my mind has not been able to contemplate any plan more likely to effect the measure than the establishment of a university. * * *"

George Washington In His Last Will.

"The Federal City from its centrality and the advantages which in other respects it must have over any other place in the United States ought to be preferred as a proper site for such a university."

George Washington's Letter to Commissioners.

"And so on this birthday of the Father of His Country I leave with you this thought: George Washington the testator, the people of the United States the executor, the bequest a university, its domicile this District, its field of toil the Republic, the reach of its ever-increasing influence and glory the boundaries of space and time."

Mr. Justice Brewer's Address at the George Washington University Convocation, February 22, 1905.

The addresses all had one common end in view, and this was most

happily expressed by President Needham: "To learn what great universities are effecting at the capitals of other nations, what they are accomplishing at the capitals of states, and what the George Washington University may be expected to do as a university of a national character, nonpartisan, non-sectarian, non-political, to incarnate the principles of the greatest American, George Washington, and to do honor to his memory by the search for truth in all departments of learning, has been the purpose tonight of this gathering." Hon. H. B. F. Macfarland, Commissioner of the District of Columbia, acted as toast master and introduced the speakers, who were as follows: His Excellency, M. Jusserand, Ambassador of France to the United States; Hon. Andrew D. White, ex-President of Cornell University, and late Ambassador to Germany; Hon. J. Q. Cannon, Speaker of the House of Representatives; Professor Richard C. Ely, head of the Department of Economics and Political Science in the University of Wisconsin; and President Needham. Letters of regret were read from Hon. Elihu Root, Secretary of State, and others. The speeches and letters abounded in expressions of confidence and good will toward the University in its larger policy, and from them we shall quote a few characteristic sentiments:

Mr. Macfarland:—"We have George Washington for our spiritual father, and so have a right to bear his great name. We are aiming to obey his last command to establish a national university in the national capital, which will be worthy of the nation which he created. What has already been done by us, and what is planned for the future has only to be known to secure the moral and material aid required for complete success. So modestly has President Needham done the work of reorganizing the University and planning its new career, providing it with a new spirit far more important even than a new site, that it has seemed necessary at this time to publicly state the progress made, and the plans for the future. We are confident that the University, now so strong, with its fine faculty, its 1,600 students, its unexampled spirit, and all the opportunities of the national capital, the natural place for a university and for research work, and already rich in the good will of this community in which it is located, will have the sympathy and support of patriotic and public-spirited Americans everywhere. The interest in the national capital and the desire of the people of our country everywhere to see it developed and embellished will not be ignored in the case of this University. The national life, informed and inspired by it, must find the crown of its expression at the national capital and in a university national in character, where ardent students, from all over the country, may behold 'the bright face of truth in the quiet and still air of delightful studies.' "

Secretary Root's Letter:—"I should have been glad of the opportunity to express my hearty approval of the work which the University is proposing to do in Washington, especially in politics, economics, international law, and diplomacy. The importance of having a large number of men thoroughly educated in these respects, grows continually, with

the increasing complications of modern life and government and international relations. Questions of internal government are becoming less simple and more difficult of solution, and there is more need that they should be thoroughly studied than ever before. Questions of peace or war are determined now by great masses of people forming popular governments, according to their opinions and feelings about supposed injuries and insults. It is of the highest importance that the people who really determine such questions shall have a correct view of what their international rights and duties are. The surest way to secure permanent peace, founded upon just conduct, is to have such an understanding, and the surest way to secure that is through the kind of work which your University is proposing to do. I know of no place in the country which has such great advantages for the prosecution of this work as the national capital."

M. Jusserand:—"A city which bears the name of Washington and a university which bears the name of Washington are bound to be great, noble and beautiful; to be the pride of the country. * * * Universities must, to be sure, produce all sorts of men; else they would not justify their name; but it is quite natural that each should pay more attention to one special kind of knowledge. Let others then choose, as their specialty, literary training, scientific training, or commercial training. The George Washington University can not hesitate and has no choice; it will become famous and be of use to the country, in being a nursery of magistrates, statesmen and diplomats. * * * A friend and guest of this town, and of this Republic, I can form no better wish for your University than this: 'May it be as successful as the *'Ecole des Sciences Politiques'* has been in France, may it prove so useful to the United States in their prosperity as that was to us, *'patriae tempore iniquo.'* May we soon see the day when young Frenchmen, returning their American friends' compliments, will come here, and study your great country, her organization and institutions, at the George Washington University, famous then the world over.' "

Dr. White:—"I count it a great honor to be asked in this place and presence to discuss for a few moments the great question which occupies all your minds, and which has so long, in various ways, occupied the minds of the most earnest men in this country. I need not remind you that as long ago as the time of him, whose name this University bears, the thought had entered deeply into the minds of our foremost men. More eloquent by far than any words which I can utter are those which I find printed on the menu for this evening. The committee in charge of this dinner did well in printing the words of Washington, and at the same time coupling with them the most eloquent tribute paid to him by my friend and colleague, and schoolmate, Mr. Justice Brewer. Nor need I dwell on the fact that so long a line of presidents of the United States have endorsed the plan of a university at Washington; nor is there especial cause to discuss this evening another fact of capital importance, which is that never has any plan for advanced education in the United States received such universal, such earnest and such devoted approval as the

university in the national capital has received from the leading educators in all the states of this Union.

"I pass all that by and come to what to me is the real question, and that is, the City of Washington as a seat for a national university. I might ask you to consider what elements are here for the establishment of a great university which shall take rank speedily among the foremost in the world. Consider for a moment the institutions which already exist. * * * Consider the Coast Survey, the Smithsonian, the Carnegie Institution, and the great government departments, with their vast laboratories, with their army of devoted assistants. Consider your great libraries, rapidly taking rank among the foremost in the world, from the Congressional Library down; consider your museums, from the National Museum down, which are also rapidly taking rank among those which are foremost in the world; and what is of still more importance than all this, consider the men, old and young, who have been drawn hither in the pursuit of scientific research and scientific study in connection with all these institutions. Certainly if there is a field in which we might expect the development of a great university, it is here in this City of Washington."

Speaker Cannon:—"The George Washington University—we are all proud of it. I have, in a very humble way, been the supporter of that University. Not by having appropriations passed, but in thirty years' service here, thirty ambitious young men from Illinois, without the means to subsist themselves, but with their feet in the soil, determined to acquire and succeed. In that thirty years, thirty of them have come and in humble positions that would furnish bread and butter have served the government, and in Washington universities, most of them in the George Washington University, have received the instruction which enabled them to go back to Illinois and out through the West and make their way for their own benefit and for the benefit of those with whom they come in contact. Each of them was assured that the moment he received his diploma, if he did not tender his resignation, I would go and demand his discharge that he might go out and utilize his instruction. I am proud of this University."

Professor Ely:—"Dr. White has said far better than I could, what is to be said about the immense advantages that exist in Washington for the study of economics, jurisprudence, and American history, and the other subjects that I have mentioned. Such opportunities exist here as exist nowhere else in the United States. The great problems of our day are centralized in Washington. We have the great departments here; we have a great body of scientific men here in Washington in the Department of Commerce and Labor and the various other departments. It is only necessary to gather together these forces and to organize them to form such a university as the George Washington University hopes to be. But at the present time these opportunities are not utilized. It is a precious heritage and I trust that the George Washington University may enter into this heritage."

ALUMNI HALL.

The trustees, faculties and friends of the University are deeply interested in the development of the plans now being made by the officers of the General Alumni Association to complete the $150,000 fund necessary for the erection of Alumni Hall, which is to be one of the group of buildings on the new site of the University in Van Ness Park. This building is to be the social center of University life, the meeting place of alumni and faculty and students, and it is most desirable that every alumnus should have the sense of ownership in the Hall, which comes from contributing, if only in a small way, to its erection. More than 100 alumni in Washington have already subscribed in sums ranging from $10 to $1,000, and the hearty response with proportionate generosity of alumni, resident and non-resident, now appealed to for the first time, will insure the erection of the building at no distant date. The Committee having the matter in charge are now issuing a circular letter containing cuts of the buildings planned for the new site, from which we reprint the following:

In developing the George Washington University in a manner commensurate with the needs and the opportunities of the capital city, to the Alumni has been assigned the task of erecting one of the group of buildings on the new site.

Alumni Hall is to be the social center of University life for students, faculties and graduates. It is to contain parlors, reading-rooms, dining-rooms, meeting rooms for committees and organizations and chambers which may be rented by visiting alumni. It will be conducted as a club for professors, students and for resident and visiting alumni.

Alumni Hall will be used by students and alumni upon the payment of small annual dues, probably $7.50. The payment of these dues will entitle the member to use the private chambers and service in the dining-rooms upon the payment of fixed charges therefor.

But every alumnus who contributes one hundred dollars or more to the building fund will become a life member of the Alumni Club and be entitled to all such privileges without the payment of annual dues. The purpose of this plan is to bring the Alumni and student body into closer relations, securing for the Alumni all the privileges of a handsome club-house, for the students the valuable asscociation with the graduates, and for the University the continued interest and support of the graduate body.

Alumni Hall will occupy one of the prominent positions on the University grounds, probably on the corner opposite the beautiful Continental Hall of the Daughters of the American Revolution. The following memoranda from the program submitted to the architects will indicate the character of the building.

BASEMENT:—This will contain a large reading room, in which periodicals will be kept, a billiard room, a trophy room, two committee rooms, and an office and a cloak room.

First Floor:—A dining room or commons will be the chief feature of this floor, either extending through two stories, with an area of about 5,000 square feet, or modified so as to give a large commons with an area of about 3,000 square feet and a smaller dinning room communicating with it with an area of about 2,000 square feet. There will be ample serving rooms, pantries, etc., adjoining the dinning room to be provided with dumb waiter and service stairs to communicate with kitchen, kitchen pantry, etc., which will be located in the sub-basement. There will also be room on this floor for parlors, smoking rooms or reading rooms.

On the second floor, it is desired to have as many chambers as can be obtained on this floor, with the necessary bath rooms. Some of these will be occupied by the students, but others will be reserved for the use, at a moderate rental, of visiting members of the Alumni Club.

The cost of the building and furnishings is estimated at $150,000.00. The Alumni have pledged themselves, by formal vote, to raise this sum, both by making such subscriptions as personal circumstances will warrant, and by using their influence among their fellow alumni and other friends to obtain additional subscriptions.

As a result of a preliminary and short canvass already made, subscriptions have been made by more than 100 alumni, in amounts ranging from $10 to $1,000 and aggregating about $7,500.00 If the alumni who have not yet been asked for subscriptions were to respond in the same ratio, the amount required would be raised.

It is known that but few of the alumni can be called men of wealth, but it is felt that all will be willing to make a contribution, even though a small one. These subscriptions may be made payable in annual installments during a period of five years, and a contribution is desired and asked from every alumnus. Let it be truly an ALUMNI Hall.

Now is the time for every loyal alumnus to express in a substantial way his devotion to Alma Mater. Subscriptions may be sent to Professor H. L. Hodgkins, Secretary of the General Alumni Association, The George Washington University.

VOL. V

NO. 3

The George Washington University Bulletin

OCTOBER, 1906

DEPARTMENT OF MEDICINE NUMBER

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THE GEORGE WASHINGTON UNIVERSITY

BOARD OF TRUSTEES

The term of trustees expires, in each case, on Commencement Day of the year indicated.

EDITORIAL NOTE.

The GEORGE WASHINGTON UNIVERSITY BULLETIN is published four times a year, under the editorial supervision of the Board of University Publications, appointed by the President's Council. It is the purpose of the Council to make the BULLETIN an organ of the educational and scientific activities of the University. The University Catalogue constitutes one number. Others are devoted to information of special interest to the Alumni and patrons of the University. Scientific numbers are published from time to time containing contributions from instructors and graduates, and information regarding books, monographs, and papers published by them under other auspices.

The present Scientific Number is devoted especially to the Department of Medicine, and a number of papers are presented from members of the Faculty and Alumni, most of which were read before the University Medical Society. It also contains notes bearing on investigations and researches being made by instructors in this department, announcements of recent appointments, and miscellaneous items of University interest. The Board desires to be kept informed as to the academic record, publications and professional appointments of instructors and graduates in all departments of the University. Communications may be addressed to the Director.

The thanks of the Board are gratefully extended to Dean Phillips, of the Department of Medicine, for his helpful co-operation in the preparation of this number.

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THE INFLUENCE OF AMERICAN SURGERY ON EUROPE.*

By Carl Beck, M.D. Professor of Surgery in the Postgraduate Medical School, University of the State of New York. President of the St. Mark's Hospital of New York.

In order to realize fully, what American Surgery has achieved, so far, and how it compares with that of other countries, it will be opportune to go back to ancient times.

The earliest surgical records come from Egypt. In the papyrus found by Ebers, the great German Egyptologist, which was written 1552 B. C., a section, dealing with tumors on the surface of the body, reads: "If this tumor comes and goes under your fingers, trembling even when your hand is still, say—it is a fatty tumor—and treat it with the knife, after which treat it as an open wound." It is maintained, that the old Egyptian embalmers had considerable anatomical knowledge which entitled them to act as "dressers of wounds," that is surgeons. The fact exists, that the Egyptians had a treatise on anatomy. According to Manetho this was attributed to Athothis, son of Menes, who reigned in 5241 B. C.

Specimens of Jewish surgery are found in the Talmud, the rabbis being acquainted with methods of suturing wounds, trephining, supplying the loss of substance.

Of Indian Surgery, the Charaka-samhita, the oldest medical work in existence, tells us many interesting facts. It is deplorable that the Sanskrit text of this work was only translated shortly ago. The Charaka-samhita was probably written in 1000 B. C. Another well-known Indian book, composed somewhat later, is the Susruta. These works contain a list of complicated surgical instruments, among them are such recommended for amputations, for lithotomy, the treatment of fistulae, polypi, sores, ascites, inhalation for cough and dyspnœa, obstruction of the intestines, etc.

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The immortal songs of Homer which supposedly were written at the same period, often allude to surgery. The nomenclature is nearly identical with that given by Hippocrates. The arrow wound inflicted on one of Nestor's horses by the bow of Paris is most scientifically described. It was at the top of the skull and had apparently penetrated the brain, which fact was diagnosticated from the symptoms, the wounded horse having convulsions and turning round and round the pole.

Aristophanes, the great poet with the loose tongue, describes the slave of Lamachus as he calls for compresses dipped into hot water wherewith he intended to treat the sprained ankle of his master.

If we study the fragments of the various writings of great Hippocrates, who was born on the island of Kos, in the year 460 B. C., we are so much surprised by the success of surgical operations performed under so many great difficulties at that period, when anesthesia was unknown, that it can be well understood that some are still inclined to doubt the authenticity of the records. The Hippocratic oath, a document of the highest rank in the history of civilization, indicates the necessity of observing the most scrupulous cleanliness and foreshadows some knowledge of aseptic rules.

Faithful as the reproductions of the classical sculptors and poets were, whose creations are still a model of keen insight into nature, stripped of fanciful and glittering flights of imagination, no less painstaking was surgery at this period, where the natural phenomena were carefully and truthfully studied by actual experiment and demonstration.

The head of the Cnidian School, Euryphon, who was a contemporary of Hippocrates, analyzes the evils of overeating most thoroughly, and as if he had foreseen the modern stomach, advises artificial vomiting for the purpose of testing the different degree of digestibility of the various kinds of food. Thus he has in fact inaugurated the "test-meal," this less aesthetic than powerful weapon of the hypermodern stomach specialist.

In this glorious period the surgeons were held in high esteem. One of the indications of their high standing may be found in the royal fees they received. The annual salary of Democedes of Croton, from the city of Athens, from the commonwealth of Aegina, and from the Samoan tyrant amounted to 8,000, 10,000 and 16,000 drachmae, that is $1,600 $2,000 and $3,200. When Democedes was captured by the Persian King, Darius, the highest honors were conferred upon him at the the royal court where he finally acted as confidential adviser of the famous ruler.

The great Roman people developed the art for which Egyptians and Greeks

had laid the foundation. The era of the Roman Emperors developed a number of brilliant surgeons, among whom Antyllus, Heliodorus, Leonides and Archigenes, may be prominently mentioned.

Only fragments are left of this admirable knowledge in the abstracts of Aetius and Oribasius, later of Paulus of Aegina. They appeal to us like the torsos of those magnificent antique masterpieces at whose overwhelming beauty we are now only able to guess. Surgical operations were performed at that period which simply astonish us.

A slight indication of what must have been lost of the immense knowledge of the great Hippocratic era, and how advanced the technics of Roman surgery must have been, may be gleaned from a visit to Pompeii. On my repeated visits to this most interesting place, it struck me that the peculiar construction of the House of the Surgeon, so well known to the readers of Bulwers "Last Days of Pompeii," pointed to more or less developed aseptic principles. The streams of water constantly flowing through the streets of Roman cities were certainly apt to remove bacteria or at least much of their favorable soil of development, and the large number of small wells in the house of the surgeon suggests, that the wounded as well as the instruments and dressings were subjected to a very thorough cleaning before and during operation. This would be in harmony with the advice of Hippocrates to frequently wash the patient before performing an operation. I can fully understand why these old masters with their fine art of diagnosis and their powerful weapon "cleanliness," have obtained much better results than the surgeons of not many years ago, who went to the operating table directly from the autopsy room, after having washed their hands in a questionable fluid, repeating their dissecting art on the living subject which thus frequently became a premature specimen for the autopsy room.

The surgical instruments excavated at Herculanum and Pompeii and exhibited now in the National Museum at Naples, are all of the most admirable perfection. There are many apparatus which many a spectator thought to be devised only half a century ago. But they existed before the advent of our Lord. *Tout comme chez nous.* The instruments all being made of steel or of bronze, are naturally aseptic.

With the downfall of the great Roma surgery took a speedy decline. Only the chevaleresque Arabs learned antique culture from the direct translation of Greek sources or indirectly through Syrian and Hebrew traditions. But these gallant savants handled words better than the scalpel and with the only exception of practical Abulkasim were not talented for surgical technicisms.

The surgical literature of the Arabians being gradually translated into Latin, became known to the Christian occident, where intelligent monks, who indulged in the study of natural sciences, took an interest in it and spread it. Among these highly creditable men Guilel-

mus Placentinus, Hugo von Lucca, Brunus Longoburgensis, Theodericus, the bishop, Lanfrancus and especially Guido de Cauliaco, must be mentioned. But they were situated like the preacher in the desert, and as a whole surgery was held in so little esteem that it became a rule among the German Mastersingers of this sad period, not to accept an apprentice or disciple, until he could prove, that he was fourteen years of age, of decent parentage and "in particular, not related to any clerk, hangman, *surgeon*, or similar individual."

But fortunately, the long cheerless mediaeval night was followed by the dawn of the Cinquecento, the same merry period which gave great Christopher his chance to discover us. This era, so justly called the Renaissance, stirred up minds all over the world. Antique culture was studied in its original diction again. Old inveterated dogmas fell to the ground and criticism came up, and with it also, the Renaissance of Surgery began. The genius of fearless Andreas Vesalius of the German town of Wesel convinced Carl V, the German Emperor, that anatomy was the foundation of surgery and that unless the government would permit of dissection for scientific purposes, surgery would remain a living lie.

That day in fact, on which autopsies became legitimate through the Hidalgo-philosopher on the German throne, marks the resurrection of surgery.

Now the splendid epoch stamped by the genius of French surgeons, followed. Ambroise Paré reintroduced the ligature of the blood vessels, his large experience on the battle-field also enabling him to advise a more simple kind of treatment of gun-shot wounds. Surgical schools were founded in France, J. L. Petit, in contradiction to his name, becoming the greatest representative of the surgery of the eighteenth century, Désault founding the first surgical clinic, and Larrey, of whom a Napoleon said that he was the only living man whom he ever respected, showing us the greatest and noblest of all military surgeons. The largest influence upon the surgical world was exerted by Dupuytren, however, who was not only the great master of the scalpel, but also excelled by his thorough understanding of pathology, which was at his time in its infancy.

While the French were on top, our English brethren were by no means lazy. Nearly three hundred years ago Harvey detected the circulation of the blood vessels. In John Hunter we see the great surgical pathologist of the eighteenth century, and in Astley Cooper and Spencer Wells the bold but conscientious operators. The greatest blessing which the surgical world received from Great Britain, however, was the antiseptic wound-treatment inaugurated by immortal Lister.

In Germany the far-seeing eye of Vincenz von Kern gave us the open wound-treatment, the principles of which have come to honor

again. Scientific pathology, born in the same country, brought reforms, which, like monuments, *aere perennius*, will forever stand in history. The theoretical reflections of Rokitansky, Skoda, Helmholtz, and Virchow were soon utilized in practice by surgical masters like Dieffenbach, the father of plastic surgery, by Stromeyer, Von Langenbeck, von Esmarch, Volkmann and Billroth. The discovery of the Roentgen Rays, which revolutionized some of the most important departments of surgery, has also added new lustre to the German laurels. The highly developed university life favored the universal direction of the minds, so characteristic for the nation of thinkers and dreamers, their tendency to deepening of thought and their admirable endurance in methodical work, were factors which made Germany the center of pathological science, this great fundament of modern surgery.

Still, the art of surgery could be practiced only under the greatest technical difficulties on account of the pain the patient had to endure during an operation. Long procedures could not be carried out at all, therefore the manual skill of the old surgeons, who were forced to perform their operations with the greatest possible hurry, must have been enormous and calls for our highest admiration.

It is assumed, that in ancient times anodynes were known. The potion, which the Trojan Helen was able to brew so well and mischievously, was supposed to banish care and dispel depression. The women of Thebes prepared the "Extractum Thebaicum, irae et tristitiae medicamentum." It is reported of Julius Caesar, that before he escaped the pirates, he put them to sleep by dropping a narcotic into their wine.

How far these reports are true, cannot be proven. It is certain, that at a remote period we see a manifold interest displayed in the study of bodily pain and its alleviation.

During the classical age, which left us the most wonderful expression of physical pain in the matchless Laokoon-group, bodily pain was frequently represented on the stage.

But there is no indication that ever before a surgical operation was performed during which the patient did not suffer the horrid agonies of combined physical and psychical pain, until it was reserved to the United States of America, to give the world that immense blessing, anesthesia. The discovery of sulfuric ether in 1846, as a safe means for making a patient senseless without any danger to his life, brought more progress in a few years than thirty centuries had brought before. Operations could be performed now, the possibilities of which our ancestors could hardly dream.

The name of the discoverer, Dr. W. T. Morton, of Boston, should be a household word through the entire civilized world. But, alas,

there is hardly one non-medical man who knows even the name of this greatest benefactor of suffering humanity.

Nothing illustrates the peculiarity of human nature more clearly than the deplorable fact that the public at large ignores such men. Public squares are ornamented with the statues of generals, whose victories were sometimes won in spite of rather than because of their abilities, or simply by the bravery of their subordinates. The truly great hero, who has sacrificed himself to find the means of preserving lives instead of destroying them, is forgotten; while the least thing gratitude could do for him would be to erect a monument in every village of the earth.

To those of our European confrères, who are still endeavoring to belittle American achievements, it may be said, that if America had contributed nothing else than anesthesia to surgery, it would have done well enough.

But it has contributed a great deal more. It is true, in general the United States could not parade with their medical education of thirty or thirty five years ago. Preliminary education was not obligatory and more than one brave Agricola metamorphosed, like great Cincinnatus, who was called to the head of the army from his plough, into a faithful son of Hippocrates over night. Only eighteen years ago any candidate could even in the best eastern strongholds of science be promoted to the degree of an M. D., after having studied for two years. We may be somewhat ashamed of that period but at the same time, we can well boast of the rapidity with which the change to the better was made. It would have taken a century in the old world to accomplish that progress which was made here in a decade.

And if the whole truth will be said, then our criticizing colleagues in Europe must not only accentuate the state of cloudiness, ignoring the bright sun-rays which were shining even through the darkest epochs of American history.

It is true, American medical training is still briefer than European. But even when American physicians graduated after a two years course, they knew well that their training was incomplete and the majority tried hard to perfect themselves. Most of the European physicians went into practice after four years study then; but many of the Americans became assistants in hospitals, or practiced under the auspices of an experienced physician several years, thus doing voluntarily what the law might well have required. Today the plan of study in American medical colleges embraces a term of four years, while in Germany, France and England it is at least five. Now, while this is a year more, we may emphasize that the American student really studies and loses no time in libations and duels. The control which the recitation scheme exerts compels him to stick to his work. This, perhaps, makes him somewhat too solemn, while

the average German student represents the other extreme. The American student might well absorb some of the poetic qualities of his hilarious German confrère, while the German student would be benefited by adopting some of the more business-like methods of his transatlantic commilito.

Of course, the great European institutions, especially those of Germany, England and France, serve as models in many respects. They are well endowed by the government and the professors do not go into the fight for existence. Still, not meaning to belittle their admirable work, the question might not be out of place: How would it compare, if they had to make a living from their practice, at the same time? We deplore this fact, but we cannot help admiring the American medical soldier who fights his daily battle at the sick bed, and still has enough energy left to spend the midnight hours at the laboratory, while every new problem he solves is intended to prevent disease, and thus to lessen the earnings of his own profession. Is there anything less selfish in this world? Common sense appreciated long ago that the medical scientist and teacher should be more independent from practice; yet it may be doubted whether a teacher who is not at all engaged in practice will be best fitted for instruction after all. The teacher must never lose sight of the fact that whatever his research may tend to, it must always be to the benefit of human beings, if he does not want to lose his vital relation with the greatest of all professions.

It is true, that to the extraordinary thoroughness and perseverance characterizing German investigators, the medical sciences are greatly indebted. On the other hand, a great deal of time and opportunity has been wasted by this praiseworthy quality on trivial subjects. Virtue may become a fault, sometimes, as Goethe says: "Wohlthat wird Plage." No American could, for instance, be found who would devote a lifetime to write six volumes on the iris of the viper. It was reserved for a German investigator to display such loving interest in a snake.

The motto of the American is utility. Where he sows he expects fruit. He has a keen eye for the "proficit and deficit." This, also, is both his virtue and his fault. No wonder that he astonishes the civilized world—not only in surgery—by the brilliancy of his technics. Theory is not the sphere he enjoys; it is practice. Goethe may have thought of the American when he says in Faust:

> Grau, theurer Freund, ist alle Theorie
> Und gruen des Lebens goldner Baum."
> (Gray, my dear friend, is theory,
> But ever green, life's golden tree.)

And while Germany will probably keep its leading position as far as the theoretical branches of medicine are concerned, the United States will become authoritative in practice. Asepsis, the daughter of antisepsis, while the result of the research of Pasteur, Lister and Koch, was methodically introduced into practice by von Bergmann. But the greatest perfection of the new method has an American trademark. Nowhere are aseptic technics so commonly practiced and so perfect as in the surgical strongholds of the United States. The natural cleanliness, so characteristic of American habits, has of course been a most favorable element for the introduction and appreciation of aseptic principles.

The American nation is acknowledged all over the world as the cleanest. It is therefore not astonishing that asepsis has been more highly appreciated here than anywhere else, and it is easy to understand that this country is destined more than any other nation to develop asepsis to its fullest perfection.

It is safe to say that in many respects the United States have fulfilled a noble mission in this direction for many years, a task not to be underestimated. There are a number of signs indicating that this characteristic sense for cleanliness has, like some other American virtues, influenced other countries indirectly. What a change, for instance, is observed in immigrants who come from semibarbarous districts, where even an annual bath is regarded as an extravagant and foolish luxury. They sometimes carry all imaginable varieties of mother earth, especially on those surfaces of the body not covered by clothing. When they scratch themselves for obvious reasons they become self-inoculated with the germs harbored in their well cultivated filth. As bacteriological investigations prove, all sorts of pus-producing germs are found in their skin; so it is only too natural that the skin surface of such individuals is covered with boils and swollen glands. The example of their new fellow citizens soon teaches them a good lesson, and in the second generation the sense of cleanliness is generally very well developed.

Of course, there will always be some who are never able to be thoroughly clean, no matter how often they are admonished. Originally, it is true, such virtues arise more from a trait of character than from education. Some, so to say, are born clean. Still education does a great deal. The youngster always reflects the mother more or less. If he is clean, there is little doubt that his mother took pains in teaching him how to clean his hair, his finger-nails, the sole of his foot, his mouth, and his clothing. And external cleanliness often is the reflection of the purity of character. Tell me who your mother is and I will tell you who you are.

And most important is this virtue in the members of the medical

profession. A physician whose exterior is not absolutely clean should be invariably rejected by his patient. If his finger-nails are not scrupulously clean, the same hand which should be destined to destroy disease is apt to produce it.

There is even among the commonest American people a natural sense for asepsis, similar to that in the old Roman sister. This accounts for the enjoyable fact, that the American patient so-to-say enters the atmosphere of the operating room in a kind of aseptic disposition.

It is by no means surprising therefore that the mortality rate of some American surgeons to-day is lower than that in any other country, the mortality in some of the important abdominal operations descending to less than 1 per cent.

But there are still more sun-rays in the history of American surgery, which, I feel justified to say, reflects the extraordinary history of this country. Many such rays were shining even during the interregnum, that much criticized period, because medical men arose whose names will never vanish from the medical history of the world. We may only mention the names McDowell, Warren, Sims, Mott, Parker, O'Dwyer and Corning. Europe should not forget, that at the time when French surgery was at its zenith, when French professors dictated the surgical fashions, when Dupuytren, the greatest surgeon of his time, refused to be operated on, saying that "he would rather die by the hands of God than by those of his colleagues," the genius of the simple American country physician, McDowell, broke the prejudice of centuries by performing the first ovariotomy. Dupuytren had strong reasons for his despondent standpoint, because he suffered from a pus-chest and among fifty operations, carried out by him for this condition, forty-seven were unsuccessful. To-day, thank God, the proportion is reversed.

It was shortly afterward that Valentine Mott astonished the surgical world by his ligation of the arteria innominata.

Modern gynecology is the creation of Marion Sims. He was a country physician, like his southern colleague, McDowell, and like the great German, Robert Koch, who was a village doctor until his forty-fifth year, his immortal experiments, which showed the tubercle bacillus to be the cause of the most important human disease, having been made far away from, and uninspired by, great university centers. It was O'Dwyer who invented laryngeal intubation; Corning is the father of spinal anesthesia; Senn's intestinal suture is used, and Murphy's method of uniting the intestines by his ingenious button, is practiced all over the world.

And what would the knowledge of the most important abdominal disease be, had American ingenuity not lifted the veil from the pathology of the vermiform appendix and exposed its mischievousness?

The old world was always used to give us, but in reference to the knowledge about appendicitis it had to receive from the young transatlantic giant. The American perspective is now being accepted by the European surgeons, their views becoming greatly altered at last. How the majority stands now, may be illustrated by their attitude during a discussion of one of the leading medical societies of Germany, which I had the privilege to attend.

The discussion on appendicitis, which was inaugurated by the Berlin Medical Society on July 18th, attracted so much attention in fact, that its distinguished President, Professor von Bergmann, was induced to call two subsequent meetings for the exclusive debate upon this special subject. Most of the eminent teachers of the Berlin University participated, among them Olshausen and Landau, the gynecologists, Kraus, the greatest German internist of the present day, Henoch, the pediatrist, Ewald, the enterologist, and the surgeons Israel, Krause and Rotter.

Almost all pleaded in favor of early surgical interference. Although it was most gratifying to hear the same views expressed, for which many American surgeons have been fighting for the last twenty-five years, it was disappointing to find that no allusion was made to their immortal merits in this respect. As this omission was pre-eminently based upon the traditional European ignorance concerning medical events in the new world, I was glad to avail myself of the chance offered to me by the kind invitation of the President, to congratulate the distinguished society on having become so thoroughly Americanized in the question of appendicitis.

Especially did I emphasize the fact that a glance over the tremendous literature of this most important part of the surgery would reveal that until a few years ago the early operation for appendicitis was regarded an adventurous policy in Germany. "Only an American would do such a thing," a celebrated surgeon in Berlin said to me not more than eight years ago, when I tried to convince him that the apparently mild symptoms of this disease were frequently misleading and often contrasted greatly with the severe pathological condition of the appendix.

This knowledge, that in the majority of cases it is impossible to make an accurate diagnosis as to whether there was a so-called catarrhal appendicitis or a beginning perforation, was gained by American surgeons who learned the facts from their frequent autopsies in vivo. That the infection was much more dangerous than the well guarded scalpel, is an American axiom. That early interference, even with the risk, that once in a while, an unnecessary operation may be performed, is the safest procedure, was proven by the extremely low

death rate of such American surgeons, as were given an early opportunity to operate by the family physician.

It was the genius of an American surgeon, which introduced the most important diagnostic factor in appendicitis, McBurney's point, into medical science. American surgeons, like Senn, Weir, Bull and Murphy, were the pioneers and advocated the necessity of removing the appendix during the free interval, that is even after a patient had recovered from an acute attack, because they realized that with a few exceptions the disease had passed over into the chronic stage only. It is perfectly true that to the Germans belongs the credit for first having given a correct scientific description of the inflammation of the vermiform appendix. But they missed the causal nexus entirely, attributing the pus-accumulation in the right iliac fossa to an inflammatory process in the loose connective tissues which surround the caecum. It was not more than logical therefore that they gave this condition that fatal term "perityphlitis."

The first description in 1830 is from the pen of Goldbeck, under the auspices of his teacher Professor Puchelt, of Heidelberg, the same celebrated university to which we are indebted for the first description of cholelithiasis. (Loewenberg in 1554.)

Less than thirty years ago great Friedreich of the same old alma mater taught, that perforation of the vermiform appendix might be caused by the irritation induced by a grape seed, this occurrence always leading to death. Fortunately he claimed this kind of "ulceration" was extremely rare, inferring from the fact that he had not seen more than two cases of this kind. When I then, jurans in verba magistri, attended these lectures as a student, I hardly thought of ever seeing more than a few cases during my surgical career, while the more mature knowledge I had the privilege to obtain in this country enabled me later to remove more than a thousand appendices. Although Schmidt as early as 1847 came very near describing McBurney's point by calling attention to the peculiar intensification of the pain produced by pressure in the caecal region, emphasizing at the same time, the fact that the area of pain hardly exceeded the size of a nickel, none of these great thinkers, strange to say, thought of the most obvious indication of attacking this area directly.

In spite of the most convincing proofs brought by American surgeons in favor of early interference, the Germans, otherwise so progressive, until recently remained obstinate in their so-called conservative treatment of appendicitis, which, in other words, was nothing but a peculiar form of therapeutic nihilism. It is remarkable that the same men to whose genius we are forever indebted for the elementary knowledge of the surgery of the alimentary canal, liver and kidneys, were so long perplexed by the appendix. Let us be grateful that the

nation which produced a Kant, the man of the categoric Imperative, has at last begun to respect the little treacherous rebel. American surgeons do not imagine even now that they know all about appendicitis. They have still left a good deal to their European confrères for further development, and no doubt they are justified in expecting especially, much from the theoretical research of German scientists.

The etymological conscience of the great Berlin society was again disturbed by the Greek ending of the Latin word, a union, which they regard as a misalliance. The terms perityphlitis, perityphlitis appendiculas, epityphlitis, scolecoiditis were again proposed for substitution. It is true that all these terms are irreproachable from an etymological point of view, but as to their real meaning they are absolutely misleading. The term "perityphlitis" has done incalculable harm, as it greatly diverts the mind from the real source of the evil, while the term "appendicitis" means exactly what it signifies. And moreover the whole world has become accustomed to it. Therefore the "term-scavengers" will have to swallow the pill after all, whether they like it or not. In German it may be compared with indulging in onions—Man weint dabei und isst sie doch.

Usus est tyrannus! They should remember that medical etymology shows a large number of more or less euphonious terms, which are unjustifable or even senseless. Bronchus means passage for beverage Arteria airpassage, Parenchyma, effusion, Muscle, little mouse, and we are so much used to them and know their meaning so well that none of us would seriously consider proposing their abolition. The etymological autodafé on the part of the term-scavengers made the word appendicitis only more popular. We may predict that the American term will be used all over the world as long as there shall be a human appendix.

Especially the German term-scavengers should consider that the language of Goethe, Schiller and Lessing contains words which are nothing else but ungrammatical nonsense. And they are by no means compositions of foreign words, nor do they represent one of those special medical terms, which are so sarcastically rated by our good friends the philologists. No, they are used by them in every day language without any scientific rumination.

Is there for instance, a greater absurdity, than the German word "Bediente," which means exactly the opposite of what is meant? The "Bediente" in fact is the master, he is the individual who is served, not the one who is serving. But this term is still better liked in literature than the simple and correct "Diener," as if this word gave him a kind of an aristocratic odor.

"Ein bedienter Soldat" is just as wrong. In some German universities the term "Chirurgischer Instrumentenmacher" can be witnessed

from the windows of the auditorium of celebrated philologists and in Berlin numerous "Bohemian Fruit Stores" are found, although a fruit store in the capital of the German empire must naturally be German. It is not the maker who is surgical, but the instrument, and it is not the store which is Bohemian but the fruit. To the same etymological jurisdiction belongs "der duerre Zwetschgenhaendler."

The proposition of Professor Kraus, to request the government to demand more particulars as far as the statistics on the morbidity as well as the mortality of appendicitis are concerned, fell on fruitful ground. The Secretary of State, who honored the meetings by his presence, promised to see to it, that every German physician should be provided with question blanks for the purpose of entering the details of his experience, especially regarding diagnosis and operative treatment of appendicitis. In this respect Germany may serve as a model, and while the American physicians do not need as much elucidation in reference to appendicitis as the German, it will be of general benefit were they to adopt the same plan.

Another sign of American influence is found in Berlin. There the physiognomies of the good old Charité, the venerable temple of Aesculapius of the Berlin University and its neighbor, the anatomical institute, have greatly changed since last year. A score of large, modern buildings was erected, Orth's pathological institute, Hildebrand's surgical, Henoch's pediatric and Lesser's dermatological clinics simply representing the best and most progressive institutions of their kind. There is in fact a remarkable combination of architectonic beauty and general usefulness.

The greatest progress, however, being made in Berlin at the present time is represented by the new anatomical institute. No American should fail to visit it, not only because it is a real delight to look at it, but especially for the reason that its construction is based upon American ideas.

We have all reason to be proud of the fact that Professor Waldeyer, the greatest anatomist of the present age, who has instructed most of our eminent teachers of anatomy, gives full credit to the excellence of the American institutions which he had visited twice during the last few years.

"The Americans" such are Professor Waldeyer's own words, "are ahead of us Germans in many respects. The idea of placing kitchen as well as operating and dissecting rooms under the roof, wherever it was practicable, struck me as an extremely good one and I made up my mind at once to persuade the Prussian government to adopt the American plan in the construction of the proposed new anatomical institute, that is, to provide for abundant light from above as well as from the side."

"How can we draw students from America, as long as our dissecting

rooms are dark and antiquated, while the new world is so far ahead of us in this respect?" was the argument, which convinced the Prussian Minister of Education after a long struggle.

The immense building is now almost completed. There are four large rooms or rather halls, which permit of simultaneous dissecting by 400 students. The space in fact is now so ample that each of the students of the second course, who have to dissect vessels, nerves and the sensorial organs, has his own table during the entire year.

Like Professor Waldeyer, who has become so true a friend of this country, many great European scientists have visited us. The International Congress of 1904 in St. Louis brought no less than one hundred and forty illustrious men from the other side to these shores. All were full of praise and if men, like Helmholtz, von Esmarch, Czerny, von Winckel, von Mikuliciz, Lorenz, Tillmanns, Escherich, Trendelenburg, Orth, Harrison, Segond and Faure asserted that they could not help learning a great deal during their visits in America we may safely believe that this is not merely a courteous phrase. The great European scientists who studied this country by personal inspection, are all admirers of it. It is only the small man, who enjoys belittling whatever comes from America. "What good can come out of Nazareth?" those idiots say.

Ewald, another celebrated visitor, wrote in an editorial of the Berlin Clinical Weekly four years ago: "How long may it take till we must go to the United States, as the engineers and men of industry had to long ago, to accumulate new scientific knowledge? Then the scientific exchange will not be one-sided but mutual."

The time has come. Where else is there a country with such immense resources and the ambition and the brains to utilize them? Where else is the spirit of liberality which receives the foreigner like a brother? The dawn of a new and glorious scientific era can be well perceived on the American horizon.

Yes, the time of reciprocity, for which we hoped so long, has come. Let us compete with our European confreres by mutual exchange. Let us visit Europe as frequently as possible and let the Europeans visit us. Let them give us their refined knowledge, based upon classical and fundamental research, and let us show them the splendid technical achievements which are so characteristic of the United States. If anything can help to secure eternal peace between the nations it is the strengthening of their scientific ties.

THE STUDY OF THE PHYSIOLOGICAL EFFECTS OF CHEMICALLY RELATED SUBSTANCES.*

By Charles E. Munroe, Ph. D., Professor of Chemistry and Toxicology

Through your kind consideration it was my privilege to be present at the initial meeting of this body when the objects sought were set forth, its plans formulated and its organization perfected, and as one who has been long connected with the University, I was much gratified to find that you had caught the spirit which now pervades our Alma Mater and had given expression to it in the best possible form by bringing together a body of its graduates for the promotion of professional study and the interchange of information and of the results of experiences. Admitted thus to this association, it is my desire to contribute so far as possible to its advancement and though my own profession is and my training has been in a different field, I may, perhaps, be permitted to urge you in the larger interest of your profession and for the credit of your Alma Mater to lend the influence of this society to fostering original research on broad lines, independent of professional applications, and carried on in so exhaustive a manner that the results will be distinctive and significant.

Every one of you can undoubtedly point out special and attractive fields for research, which, properly cultivated, would yield valuable results, for your profession is so many-sided and so all-embracing that it presents problems for solution at every point and furnishes opportunities for men of widely varying capacities and equipment to do useful original work. Naturally the field which I would advocate and urge you to cultivate is that one where the professions of chemistry and medicine meet.

From remote times the animal, vegetable and mineral kingdoms have been drawn upon to furnish curative agents for bodily ills. We now know that from each of these sources substances may be obtained which have a decided action upon animal organs and functions, but until very recently these materials have been used in a wholly empirical manner, and to-day, as the old remedies are used, they are still employed empirically. In fact, until chemistry became a science and the composition and, more recently, the constitution of the substances contained in, or obtained from, the materials used had been demonstrated, it was impossible to gain any rational idea as to their

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behavior and particularly as to the changes which they undergo in the body.

Although for two centuries many inorganic substances and some organic substances have been prepared in the laboratory and factory in a fairly pure and definite condition and much has been known about them, yet it is only in the last half century that we have begun to acquire a definite knowledge of the constitution of chemical substances and to recognize that their properties are dependent now only on the matter of which they are composed, but also upon the manner in which that matter is arranged, or, to formulate this on the atomic theory, that substances differ because of the kind, or the number, or the relative arrangement of the atoms of which their molecules are composed, and, following out this last statement, we find that as the molecular atomicity increases the number of different substances having distinctly different properties which may be produced from the same number of the same kind of atoms is enormous.

This information has been gained not alone by the analysis of these substances, but by their synthesis also, and further by a close study of their behavior on analysis and synthesis and when acted upon by well-chosen reagents. Through these means it has been found that, as a rule, the arrangement in any given case is definite and that, moreover, portions of these organized substances tend to act as a unit and to enter into and issue from chemical reactions as elementary atoms do and to possess in themselves specific properties. These compound entities, known as radicals, are then to be counted with as the elements are and in any consideration of the physiological action of the substances of which they form a part they must be taken into consideration as entities.

The discovery of the fact that complex substances could be built up as well as torn apart and that through this means substances, and especially organic substances, occurring in nature could be produced in the laboratory has given an immense impetus to the pursuit of chemistry, and this has been further stimulated by the fact that it has been found possible to so control the union of these atoms and radicals as to form new compounds not heretofore found in nature, though many of them are built upon the same type as those which occur naturally.

As a result many organic substances like indigo, alizarine, methyl salicylate, vanillin and the like, which were formerly obtained solely from vegetable sources, are now wholly or largely produced artificially, while an enormous number of synthetic preparations, which is daily being added to, are offered for use in the arts and as remedial agents, and it is found that the substances thus made may be produced com-

mercially in a purer condition and giving more definite and simpler reactions than those which are extracted from complex organisms such as occur in plants and animals.

In the production and laboratory study of these bodies an enormous amount of information has been obtained regarding the importance of arrangement, as in the case of hydrazobenzene, which is an indifferent body, and benzidine, with the same empirical formula, which is a diacid base; methyl cyanide with an agreeable odor resembling leeks and the methyl isocyanide with a perfectly unbearable odor; ethyl sulphocyanide with an ethereal odor and the ethyl isosulphocyanide with the penetrating properties which characterize the mustard oils; the *a*-naphthylamine, which melts at 50 degrees, possesses a pungent odor and gives an azure blue with ferric chloride, and the *b*-naphthylamine, which melts at 112 degrees, is odorless and is not colored by ferric chloride; the laevo-modification of lactic acid, which is consumed by the *Pencillium glaucum* and the dextro-lactic acid, which remains unattacked by this micro-organism. These are but a few of a multitude of examples which might be cited showing the effect of constitution on the properties of isomeric bodies. As examples of the effect of radicals we may cite the case of benzene sulphimide, familiarly known as saccharine, for if we introduce into the benzene nucleus of this substance two atoms of bromine in place of hydrogen we have a body which gives a sweet taste on the front of the tongue and a bitter taste on the base of the tongue; if instead of bromine we introduce two nitryl groups into the benzene nucleus we obtain a body which is intensely bitter, without any sweetness; if now instead of the nitryl groups we introduce two amido groups we obtain a body which is intensely sweet, sweeter even than saccharine. In fact, it is estimated that four pounds of this body will bring a ton of glucose up to the sweetness of cane sugar. Or we may point to mercaptan, which differs from common alcohol only in that an atom of sulphur is substituted for oxygen and which Richardson finds produces a narcotic effect, but acts upon the various nerve centers in the reverse order of other narcotics.

The examples of this kind which may be cited are very numerous, but I will not weary you by repeating more of them. What has been given suffices to illustrate my contention that the constitution as well as the composition of chemical substances materially affects their behavior and that this must be taken into account in determinating their value as remedial agents. Furthermore, this great variation in properties which the variation in composition and constitution enables us to obtain at will, ought to render it possible for us, by proper selection and use, to produce a desired effect or any desired de-

gree of effect upon any organ, whether in a normal or in a pathological condition, but though the means be at command, we must acquire the knowledge of how those means are to be used before the desired result can be produced.

It is my opinion that chemical science has reached so advanced a stage that this knowledge may now be acquired by a systematic review of the literature, recording the data according to some well-devised plan, and by supplementing this with systematic experiments for the purpose of reconciling or explaining conflicting reports and for filling in the gaps which exist in the former experimental schemes. I believe that in Washington we are most happily situated for carrying out such a scheme, for, as you are better aware than I, there has been an immense amount of experimental work of this kind carried out in the past, though much of it has been of a desultory character, and the literature to be reviewed is vast in extent, but the existence here of the library of the Army Medical Museum gives unusual opportunities for gathering this material together and arranging it in that systematic manner through which only can it be rendered of service.

In advocating a systematic scheme of experimental inquiry into the physiological effects of chemically related substances, I am not advancing a new idea, for the problem has been attacked repeatedly. According to Professor Benj. Silliman, Jr., Dr. James Blake, late of San Francisco, was the pioneer in this line of research, his results being published in the *Archives Generales de Medicine* as early as 1839, and his researches were continued for half a century, but they were chiefly, if not wholly confined to inorganic compounds. In the early sixties Dr. Berry W. Richardson began a series of systematic researches upon organic compounds, his results being communicated in the form of Annual Reports to the British Association for the Advancement of Science beginning in 1864 and continuing for many years. Drs. Crum Brown and Thomas B. Fraser also published in the Transaction of the Royal Society of Edinburgh for 1868-69 the results of their researches on the connection between chemical constitution and physiological action, their work being principally upon those imperfectly known bodies, the alkaloids and their substitution derivatives; and later, Dr. Wolcott Gibbs, of Harvard University, and Dr. Robert Hare, of the University of Pennsylvania, published in the *Archiv für Anatomie und Physiologie* the results of their "Systematic research on the action of constitutionally related chemical substances on animal organs," the work being confined to the study of the phenols, the nitro bodies and organic nitrates. I do not assume in these few references to have given even an outline of the literature. I have but referred to the few examples which I have con-

veniently at hand. All know how actively this field of research has been cultivated in recent years, especially in Germany, and it is so important and so promising a field that its future cultivation is ensured.

I have cited these examples, first, to show that men of the first rank in the medical and chemical professions have regarded this work as of importance; second, to show that it is one which is now open freely to any investigator, and, third, to indicate that thus far each investigator has confined himself to some special feature of the subject. What I advocate is a systematic attack upon the whole field. Of course this will require a multitude of investigators to carry it through if it ever could be completed, but on the other hand a few could plan the scheme, devise the system of tabulation and notation, and then the results obtained by investigators everywhere would contribute to its development.

I trust that what I have set forth may have interested you sufficiently so that the influence of this society may be exerted toward bringing it to pass, for if it should prove that the George Washington University had undertaken the systematic investigation of this important subject and that it had enrolled graduate medical students who were engaged in such researches it would be an additional factor in fixing it among the leading universities of the world, and would contribute most valuable aid in the advancement of medical science.

THE PREVENTION OF TUBERCULOSIS.*

By W. P. Carr, M. D., Professor of Physiology and of Clinical Surgery.

The great prevalence of tuberculosis is so well known that little need be said on that subject. It is an established fact that one-seventh of all deaths are caused by it. All persons are exposed to the contagion and it would hardly be an overestimate to say that nine-tenths of all persons living in this country contract the disease at some time in one or more of its various forms. Indeed, if we consider slight involvement of glands, tubercular ulcers, and other minor manifestations, this estimate is too low. It would seem, therefore, a great boon to humanity if its ravages could be stopped or even checked in a marked degree. Certain facts, however, tend to show that the benefits to be derived from abolishing tuberculosis would be to a greater or less extent offset by evils. Considering the matter from a purely scientific standpoint we are forced to admit that at the present day the tubercle bacillus is the greatest factor in nature's great improvement scheme, "the survival of the fittest."

Tuberculosis is a disease from which the strong are immune or recover and from which the weak die. The great number of autopsies made in recent years has proved this fact beyond cavil. The frequency with which scars of healed tubercular lesions are found in autopsies upon those dead from other diseases has been noted by all pathologists. Dr. Shute and Dr. Phillips will tell you that nearly every cadaver used in the dissecting room of our school, no matter what the cause of death, shows some tubercular lesion or scar. Many of these lesions have been healed or arrested.

A vigorous man, even when he has contracted the disease in a severe form, will recover if given at all favorable conditions. The vigorous, however, do not contract the disease unless temporarily debilitated or unless exposed continuously to excessive numbers of the bacilli.

It is quite certain that the persons saved by eradicating the bacilli would be weaklings. Many of them would be saved for lives of suffering and for the propagation of still weaker offspring. The weaklings, particularly the poor ones, having to struggle for the bare necessities of a life devoid of recreation or pleasure, would gain little by being saved from a consumptive's grave. And the

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majority of the weaklings are poor, made weak by the conditions of poverty. Child labor, poor food, the cruelty or neglect of vicious or drunken parents, unhygienic habitations, long hours of labor in shops or factories, crowding, insufficient clothing, ignorance and many similar causes produce weaklings among the poor, while excesses and indulgences are the chief factors in their existence among the rich, where they are comparatively few in number.

In the fierce competition of the present day in all pursuits of life, even the strong have little leisure, and the life of a poverty-stricken shop-girl or factory-hand affords so little pleasure and so much suffering that it hardly seems worth saving unless we can at the same time make the individual so strong that work will not mean pain.

But we must remember that most of those we would save by abolishing the germ of tuberculosis would be saved for a more lingering and painful death by other diseases. The tubercular patient is notably cheerful and hopeful. It seems as if nature had created the tubercular bacillus as a sifter of her creatures, to sort out and destroy those whose low vitality would render life to them more painful than pleasureable and that she had armed this germ with a poison having decided analgesic and pleasureably intoxicating poperties. Without the tubercle bacillus these poor creatures would be condemned to a life of toil and dyspepsia, chronic catarrhs of the stomach and intestines, and a host of other painful and melancholic diseases that have no germ with analgesic properties.

I think that physicians in their desire to save life sometimes forget that death is not the worst evil that may befall a man. If we cannot put him in such health as to enjoy his life, as to derive from it at least a little more pleasure than pain, we confer a doubtful favor by saving him. And if we save a man from death by one disease for a more lingering death by a more painful disease we surely confer no boon. Is it worth while then to try to stop the ravages of consumption? Decidedly, yes! If we can do it in the right way. Decidedly, no! If we undertake it in the wrong way. The right way is nature's way. Strength means natural defense against the germ. Make the people strong enough to be immune. Abolish those things that produce weaklings and attack the germs only when they become aggregated in such numbers as to threaten even the strong.

But first let us take a look at the wrong way now advocated by many and threatening to be forced upon us by legislation, by the politicians, lay and medical. The attitude of these gentlemen, I may remark in parenthesis, is, to say the least, ungrateful; and the position in which they would place the medical profession certainly undig-

nified. The politician in smooth and oily language of copious and subtle diction speaks in honeyed tones of the noble work of saving life, and asks the doctor's moral support and even his financial support. Translated into ordinary English his harangue is simply this: "Here, you medical men! You say you have found a way to check consumption. Now do it. Do it to the limit, or I will fine you. And, by the way, you must do it my way, not yours. Report all your cases to me that I may supervise you, or I will fine and imprison you. And, yes, you may contribute some of your wealth to support some of my charitable institutions. You don't have to do this, but I will see that you look mean and niggardly if you don't. I also ask you to endorse these measures fully and unconditionally." It would seem more modest in the politician if he should offer to assist the doctor by placing at his disposal facilities for carrying out necessary precautions in the care of poor patients. Especially when the doctor has established dispensaries everywhere for the treatment of the poor and does not need a spur to make him do his best all along this line.

The compulsory reporting of tubercular cases to municipal authorities looking to the enforcing of measures for stamping out the germ is now the vital issue. I think it can be clearly demonstrated that legislation in this connection would be, first, inefficient; secondly, that it would work great hardship to many poor patients; thirdly, that it would be a waste of money that could be otherwise used to good advantage, and, fourthly, that if it could be made effective it would deteriorate the whole human race, but this, fortunately, is impossible. The inefficiency of such legislation is demonstrated by the following facts:

(1.) The chief factor in the scheme is to be the sending to each patient printed rules to be followed so that he may not spread the germ. So far some thirty-one rules have been devised. These rules are so cumbersome and obnoxious that no patient is likely to follow them unless a special officer is detailed to watch him individually day and night. This would require two special officers for each patient. Even then we must remember that a diagnosis must be made before the case could even be reported and that there are thousands of cases not sick enough to call a physician, which are undiagnosed and which are each scattering millions of germs, enough to keep up an abundant supply even if all cases that came to physicians were quarantined. Even when a patient comes to a physician it is often a difficult matter to make a positive diagnosis, at least for a long time. And under such circumstances a physician would have to be very certain of his diagnosis or serious consequences might befall him. Besides, many

domestic animals and, perhaps, birds contract tuberculosis and spread the germs. So that even if at great expense all diagnosed cases could be made to follow the rules, it would be like trying to sweep back the ocean tide with a broom. But it may be said that this is only theory and the the "Proof of the pudding is the eating thereof." Statistics in cities where the plan has been tried are said to show great reduction in the number of deaths and cases. New York statistics show a reduction of 40 per cent. I am surprised that no more is claimed on paper. Dr. Nicholas has investigated these statistics and finds that nearly all the so-called reduction was before the compulsory reporting began, and that in our own city there was a greater reduction during the same period without any legislation. The apparent reduction in the death rate from tuberculosis has been generally paralelled by a similar rise in the death rate of pneumonia, and no insignificant factor in this phenomenon has been the attitude of insurance companies in refusing payment in cases of death from consumption.

Hardship to the poor will surely follow such legislation or any widespread exploitation of tuberculosis as a contageous disease. Every narrow-chested individual will become an object of suspicion. Suspected employes will be discharged and be unable to obtain employment again, even though they have families to support. Again, the statistician says: "No, this will not occur. It has not occurred where the plan has been tried." I have only to say in reply that it has occurred, to my personal knowledge, in several instances in this city, following the comparatively slight agitation of the subject of tuberculosis that we have had. The government should be prepared to take care of such persons and families as they legislate out of employment. Even without assuming the care of such families and without making the scheme effective by employing two officers to watch each tubercular patient, a considerable amount of money would be needed to pay for printing and the salaries of officials. This money could be much more effectively used in many ways, such as the disinfection of badly infected houses, or the establishment of country homes for tubercular invalids. In view of the foregoing facts, it seems plain that the eradication of the bacillus of tuberculosis would work more evil than good and would result in a deterioration of the human race as a whole and would considerably increase the financial burdens of the government.

Fortunately, it is an utter impossiblity to eradicate the germs or to make any perceptible diminution in their number, except where they are unusually abundant in rooms or houses long occupied by consumptives in the later stages of the disease. Such rooms or

houses should be reported to the health officials and be disinfected by them, for such concentrated accumulations of the germs are dangerous even to the strong. There are few physicians to-day who are not competent to treat tubercular cases and to use all available preventive measures. And the physician who has charge of a case has more interest in carrying out these measures and more influence with the patient in making him do his part than a strange official would have. Evidently little can be accomplished by direct warfare upon the tubercular germ, but tuberculosis can be eradicated and will some day be eradicated by fighting the disease in nature's way. Its eradication in this way will be followed by none of the evils above mentioned, because nature's way is to make the weakling strong so that he can laugh at the germ. This may seem quixotic, but is really more feasible than the method of attacking the direct germ and, vastly more economical in the end.

I can only hint at the steps by which this germ is to be eradicated. One of the most important things will be provision for the proper care, feeding and hygienic surroundings of poor children. We must begin with the children and make them healthy adults. The rich will need no attention, they will look out for themselves when the way is made plain. A way will be found to prevent the crowding of paupers in cities. They will be kept scattered in rural districts and the weaker ones provided with suitable out-door rural occupations. This may be done largely by allowing in cities nothing but light, roomy, hygienic buildings and by requiring landlords to refuse rental in cities to such paupers as would fall easy prey to the bacilli, and by offering them cheap sanitary dwellings in healthy suburbs. Transportation is becoming so cheap and rapid that many are even now finding it more pleasant and more economical to live in a healthy place outside of the city in which they work. All the numerous laws in relation to dairy and food inspection are in the right direction and are constantly tending to limit tuberculosis both in cutting out inspected food and by increasing health and resistance. Nearly all the necessary steps have been inaugurated already in some degree. It is only necessary to improve and perfect them to produce a wonderful improvement in the physical condition of the poverty-stricken classes, which are garden soil for tubercular germs. Physicians will take care of the well-to-do and carry out preventive as well as curative treatment. The great need is for money to take care of indigent children and for disinfecting dangerous dwellings. This may be furnished by charitable individuals or by the state. It seems to me a proper field for state aid and the important point upon which legislation is needed.

My main object, however, is to make plain the two plans of attacking the disease, and to demonstrate the fact that by abolishing the germ in the present condition of city life we should add enormously to the helpless invalid class and lower decidedly the physical standard of the race; that we should simply prolong and increase the suffering of many indigent persons. On the other hand, if we can first increase the resistance of these individuals nothing but good can result and a great diminution of the tubercular cases will follow. Of the two things, I think also, the latter is far more feasible and easy of accomplishment. By fighting the germ at present we are simply wasting time, energy and money that would be well expended in benefiting the condition of the poor. The time may come when by elevating the standard of resistance we have so far reduced the number of cases that a direct attack upon the germ may be profitable and lose its objectionable features. I hope that time will come; I believe it will come. But it is not yet.

A CASE OF LONG STANDING (NINE YEARS), FULL-TERM ECTOPIC PREGNANCY.*

By J. Wesley Bovée, M. D., Professor of Gynecology.

Ectopic pregnancy is by no means rare. About 5 per cent of the gynecologist's abdominal sections are made for this condition. About four per cent. of the sections for ectopic pregnancy are made for full-term cases. This is the oldest case of my experience.

The history is as follows:

Mrs. J., white, 30 years of age, was admitted to Columbia Hospital, in March, 1898. During her childhood she did not enjoy good health. Menstruation began at fourteen years of age, was irregular for the next few years, menstruating but two or three times annually, later became quite regular for a few months and then for a number of months at a time would be conspicuous for its absence.

This irregular interruption of the flow for months has continued to the present. Living in a malarial region, she has suffered more or less from malarial poisoning all her life, and this, with measles and other slight diseases, has kept her in bed a great deal. All during her premarital menstruating life she was very much annoyed with leucorrhoea. She was married at eighteen, and three or four months later had an abortion, which was attributed by her physician to heavy lifting. Her health continued about the same, and twelve months later she was delivered of a female child after a short and easy labor. No physician was present. Previous to its birth her face, eyes, feet and genitals were swollen. There was nothing of note in her condition until about December, 1888, when she began to have severe pains in the left inguinal region and left hip. A "knot" appeared in this region and gradually increased in size; a little later foetal movements were felt, and she expected to be confined in August, 1889. August 1, her physician wrote, "she was in labor, after having all the symptoms of pregnancy, and when I saw her, August 15, 1889, a diagnosis of extra-uterine pregnancy was made and the patient advised to call a surgeon." The pains continued about three months, after which period they gradually became less, but occurring with relapses sufficient to keep her in bed. Three years ago, she gave birth to a live child, and during this pregnancy seemed to suffer no more than previously, and the labor was short and much easier than the first, eight years before. During the following year, the patient enjoyed better health than

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before, but at the end of that time had another relapse and "was just able to drag around." Her weakness increased, and two months ago she was obliged to remain in bed and was bed-ridden when admitted to the hospital. Two weeks ago, she experienced great pain in the rectum and her physician removed therefrom the left parietal bone of a foetus, which she brought to the hospital. She has been obliged to take quite large doses of morphia at regular intervals during the past few months, and is clearly a victim of it. She is greatly emaciated, suffers constant pain, and is extremely sensitive to pressure in the left iliac region.

An examination reveals the presence of a tumor in the left side of the abdomen, extending from the vagina to the spleen, and firmly fixed. A finger in the vagina elicits a sense of crepitation in the mass so easily felt in the left broad ligament, slightly in front, which is thought to be a foetal skull.

On March 10, an operation was performed. The vaginal route for removal was rejected, unless an abdominal exploration determined it to be the preferable one. When the abdomen was opened the dense mass was found to be lying behind the peritoneum, and an attempt to reach it by an incision through the extra-peritoneal structures in the flank was made and abandoned, as too much dissection seemed necessary and the liability to open the peritoneal cavity too great. An attempt to stitch the peritoneum covering the sac to the edges of the abdominal incision was met with failure, and we decided to pack gauze about the abdominal incision and all about the point in the sac wall elected for its opening. The sac was then incised, and from it, after long, tedious efforts, the skeleton of a foetus, one or two bones at a time, was detached and removed with considerable quantity of faecal matter. No other parts of a foetus was found and no evidence whatever of a placenta was detected. The head was found near the spleen, and the relation of the bones with the wall of the sac rendered great care necessary to prevent puncturing the peritoneum. The skin and peritoneum of the edges of the abdominal incision were united with running catgut suture, and the edges of the sac wall were, in turn, stitched to the edges of the abdominal opening. It was now irrigated and packed with iodoform gauze around a rubber drainage tube. Two quarts of physiological salt solution was run into the abdominal cavity to be absorbed. The opening (or openings) between sac and bowel was not found or searched for, and, as expected, the bowel movements came through the opening of the sac for nearly two weeks, after which time it began to come through the anus and the fistula to close. "Scarcely any fecal matter comes through the opening, but quite a little pus" is noted on her history chart for April

1. April 10, is gaining rapidly, taking on flesh and color, and walks about the ward free of pain, although she has had no form of opium since the operation. She left the hospital for her home in May in better health than during the previous eight or nine years.

This woman suffers from a ventral hernia at the site of the drainage but dreads another operation and probably will never have it performed.

In presenting this specimen and its case history a few words concerning such conditions may not be amiss. Albucasis, an Arabian physician, living in Spain, is said to have been the first to clearly report a case of octopic gestation. About the middle of the eleventh century he saw parts of a foetus escaping by the process of suppuration, through the abdominal wall of a woman. During the sixteenth century Platerus, Horstius, Polinus, and Primerose reported fairly well authenticated cases. Those of Nufer and Christopher Bain, both classical, occurred about this time. It is probable that Nufer was the first to make an abdominal section for this condition though his operation is put down in literature as the classical first Cæsarian section on a living woman. The report of it appears in the collection of Casper Bauhin, and is recorded in Von Siebold's History of Obstetrics (Versuch einer Gesch. de Geb. Berlin, 1845, II, 95.) as follows:

"According to the relation of Casper Bauhin, in his appendix to the Latin translation of Fr. Rousset's writings upon Cæsarian section, Jacob Nufer, a swine-spayer, at Sigerhausen, in Switzerland, in the year 1500, delivered his own wife by opening the abdomen, and the operation proved successful for both mother and child. The woman was pregnant for the first time, and when labor came on and she had already suffered severely for several days, there had gradually assembled at her bedside thirteen midwives and several lithotomists. But all of them together were unable to relieve the poor woman of her child or to mitigate her suffering. Thereupon, the husband of the woman proposed to resort to the last means of saving her, and assured her that if she would take his advice he hoped, by the blessing of God, to bring the case to a successful issue. She gave her full consent, and Nufer persisted further in having the permission of the magistrate to his attempt. This, after some reluctance, was eventually obtained. Nufer next asked those of the midwives who had sufficient nerve for it to assist him in the delivery of his wife, while the more timid ones were requested to leave the room. Eleven of them chose the latter course, while two of them and all of the lithotomists remained to assist. The husband first besought the help of the Almighty, then closed the door, laid his wife upon a table and made an incision in her abdomen in the same way he was accustomed with the

swine. He opened the abdomen so cleverly at the first incision that the child was safely extracted. When the eleven midwives outside the door heard the baby cry they desired admission, but this was refused until the baby was washed and the wound closed as in the swine. It healed rapidly. She was later confined four times and bore twins. The child delivered by the operation lived seventy-seven years."

Forty years later, according to Donatus, Bain's abdominal operation was deliberately done for the removal of a long-retained foetus. It is described as follows:

"In April, 1540, at Castrum Pomponii, commonly called Pomponischi, in the Province of the Lords of Gonzaga, not far from the river Po, there lived a woman whose name was Lodovica; but from her great size termed La Cavalla. She had been pregnant and the foetus had died in the uterus, while the soft parts had sloughed through the vulva and the bony portions had been retained within her. She recovered and again became pregnant, followed by a rapid loss of flesh, and was reduced to a condition of great danger. Christopher Bain, a traveling surgeon, happened by and offered to attempt to restore her for ten golden pieces if successful, and her body if she died. She and her relatives were very poor, and most of the money was raised by their good neighbors. The woman was tied up; he slowly cut through the abdominal wall, including the peritoneum, and at last opened the uterus and extracted the skeleton of a male child; he washed out the uterus with some warm wine and aromatics, and after cauterizing the edges of the wound, closed it with a suture. She recovered and in a short time had other children born in good condition. Later she had four in all. Witnesses: Dominus John Baptist Zorzonus, and Alexander Begher, Dominus Frederick de Filini, and Dominus Leonellus Zorzonus, and Antonius Maiochus or Mazzuchinus, and several others, present at the whole operation."

This operation was probably for an ectopic gestation, and was done fifty-four years before that of Primerose. About this time Platerus did his operation successfully (1594). In 1604, according to Webster, the first case of tubal pregnancy was reported by Riolanus, the younger, and the same author regards the first case of ovarian pregnancy reported to be that of Mercurus, in 1614. But of abdominal pregnancy the first good account is by Josephi, in 1784, and the first clear description of interstitial pregnancy was by Dionis, in 1718. To Madame Lefort belongs the credit of having first reported clearly, in the eighteenth century, a case of developed ovum between the layers of the broad ligament, a condition that in 1836 was called by Dezeimeris "Subperitoneo pelvic" pregnancy. Lawson Tait's investigations led to the determination that practically all cases of extra-uterine

pregnancy are originally tubal, becoming other varieties, often, by escaping from the tube. His views on this subject are generally accepted by the profession.

It is interesting to note that most early writers considered the foetus had escaped from the uterus, and gave histories of injuries at some date during the pregnancy that had caused much extrusion. Altogether, the study of these early cases is very enchanting.

The longest period we found mentioned during which a foetus had been retained in the abdomen of its mother was fifty-seven years (Nebel). Sappey reported one of fifty-six years, and we found nine others of more than fifty years; six between forty and fifty years; ten between thirty and forty years; and forty-three between eight and thirty years, beside a considerable number in which autopsies on aged women revealed the presence of dead foetuses in various stages of decomposition, and without histories of such pregnancies.

The condition of the foetus in ancient ectopic pregnancy is variable, being apparently but slightly dependent on the time it has existed. Bayle removed postmortem from a woman's belly a foetus in good state of preservation that had been there twenty-six years, and Watkins one forty-four years old that was loose in the abdomen and perfectly well developed and preserved. Per contra, many cases are found in which trouble is caused by putrefaction, septic infection, sloughing into hollow viscera, or other depressing condition, within a very short time after the death of the foetus.

It would seem that the duration of retention of an extra-uterine foetus of advanced development depends largely upon whether the conception product becomes infected. The limit of time during which these foetal cysts may remain in the abdomen unmolested has not been determined, inasmuch as in a number of the very oldest cases death was due to some entirely irrelevant cause. In about 76 per cent. of the cases (Charpentier) infection occurs, and nature attempts to eliminate the foreign material and is oft-times successful, although in a large majority of them, if unaided by surgery, the women die of exhaustion as a result of pain, long profuse discharge, or sepsis. In the remainder, about 20 per cent., the foetus remains either in a fair state of preservation or changed by fatty degeneration, absorption of soft parts, calcification of the sac wall, or other metamorphosis. A true lithopaedion of the foetus does not form. Elimination, when attempted, is in about half the cases into some portion of the bowel, nearly as often through the abdominal wall at some point, far less frequently through bladder or vagina, and in one case through the perineum.

Location of Foetus.—Various authorities have insisted that nearly all

cases of full-term ectopic gestation are intra-peritoneal. This is not readily reconciled with the preponderance of evidence going to prove that absorption of a young ovum placed in the peritoneal cavity progresses rapidly. Taylor and Webster agree that abdominal or intra-peritoneal gestation is uniformly fatal (unless removed by abdominal section), primarily by hemorrhage, secondarily by suppuration of the sac and peritonitis. Of course, the amount of hemorrhage may be so slight as to cause no alarm, and is usually least when rupture is near the fimbriae. Again, the foetus may escape in its unruptured membranes into the peritoneal cavity, the placenta preserving its attachment to the inner surface of the tube. Webster, Taylor and others have recently published views directly antagnotistic to this belief, and the author believes that while it is possible to retain a foetus sufficiently long in the Fallopian tube for its arrival at such a stage of development that when suddenly expelled into the peritoneal cavity it will resist absorption, and that intra-peritoneal pregnancy may occur without passing through the broad ligament, but that practically all full-term ectopic gestations are, or have been, broad ligament pregnancies. Either the pregnancy develops and remains extra-peritoneal, bulging either the anterior or the posterior fold of the broad ligament, or has finally ruptured through the peritoneum into its cavity. The case herein reported, and one we previously recorded, were unquestionably extra-peritoneal. Dunning's interesting case was of this variety, and many of those reported during the past few centuries were clearly proven to be of this type. It is probably those old cases that opened into the bladder, vagina, or peritoneum, or into the bowel, as did the one herein detailed, are of this variety, and even some of those opening through the lower part of the abdominal wall may have dissected up the anterior layer of the peritoneum, and here escaped without even having invaded the peritoneal cavity.

Pregnancy and Labor During Ectopic Pregnancy.—Another interesting feature of the case herein reported is that while in possession of the old ectopic gestation the woman again became pregnant, and was delivered of a living child after a very easy labor. This interesting condition has occurred in at least quite a large percentage of cases we have studied, and even in a few instances two different estopic pregnancies have been found at the operation or autopsy. These were usually of different stages of development, being either of the same date, and one becoming blighted first, or altogether different as to age.

Treatment.—Parry and others of the early writers on the subject of full-term ectopic pregnancy have been opposed to surgical assistance except when the life of the woman was clearly in immediate

danger. But that was before surgical invasion of the peritoneal cavity was so safe as it is now, and the views expressed have been gradually tending toward surgical relief as the routine treatment for this condition. The principal cause of death in abnormal section for these advanced cases is sepsis. It would seem that if the large majority are extra-peritoneal, many of them would not require celiotomy. However, if a transperitoneal operation be necessary, then treatment of the sac by stitching it to the abdominal wall before opening it, or when not possible, afterward, would be the most approved plan of procedure when the sac cannot be enucleated.

When much denudation of tissue in the pelvis results from cystectomy, then drainage through the vaginal roof will be advisable. Although the operation may be done thoroughly aseptic, if, in these greatly weakened women, a space is left in which accumulation of fluids may exude, we must expect its infection before absorption of it occurs, and a considerable loss of life to result.

A MORE LIBERAL DIET IN TYPHOID FEVER.*

By Thomas A. Claytor, M. D., Professor of Therapeutics and Clinical Medicine.

This subject has been approached with some hesitancy for two main reasons: First, the profession, as a whole, is strongly opposed to more liberal feeding in enteric fever, and one who advocates it runs the risk of sacrificing, to some extent at least, the confidence which may have been reposed in him by his brother physicians; second, an argument in favor of a more liberal diet might be misconstrued into one for too full a diet, and thus do harm.

I wish to present to you the results in a small number of cases, twenty-six in all, which I have treated on a more extended dietary during the past year. The results have been no better, as far as ultimate recovery goes, than in cases treated with a more restricted diet, but my patients have been far more comfortable, happier, and have, I think, convalesced more promptly.

The treatment, dietary and otherwise, of all diseases has changed from time to time, but it must be acknowledged that typhoid fever, from the days long before it was separated from other continued fevers (1813-1837) to the present time, has been rather a notable exception. Following the precepts of Hippocrates, Galen, Celsus, and a long line of distinguished physicians urged a very rigid diet during the acute stage of fevers, consisting chiefly of barley water and the like. In the latter half of the seventeenth century the teachings of Thomas Sydenham, who followed a vigorous antiphlogistic plan, had a strong influence on the feeding in continued fevers. Water-gruel and barley-gruel represented his dietary with the addition of a few spoonsfuls of broth several times a day. During the eighteenth century and the early part of the nineteenth, the diet became more liberal but was exclusively vegetable. Farinaceous gruels, fruit juices, and soft fruits were allowed. Very restricted diet prevailed, however, until the time of Graves of Dublin, whose influence was felt in the latter part of the first half of the nineteenth century. He was considered to have very liberal ideas as to feeding in fevers. He recommended well-boiled gruel with sugar and lemon juice or panada, of which a spoonful was given every third hour. In France, Brossais, arguing from the basis that all febrile conditions depended upon gastrointestinal irritation, urged a most rigid diet in fevers. The

*Read November 18, 1905, before The George Washington University Medical Society.

doctrines of Brossais were attacked by Trousseau, Herard, Monneret and others, and were finally overthrown in 1857.

Milk did not come into favor until the last third of the past century, but since that time it has been almost the sole dependence in typhoid fever.

It would appear from the foregoing that there has been a gradual, very gradual, tendency to increase the amount of food given in continued fevers ever since the time of Sydenham, and I should not be surprised, if in less than fifty years, those looking back over our exclusively milk diet will feel much the same sympathy for our patients as we feel for those poor fellows of not so long ago who, though parched with thirst, were allowed little or no water. The argument advanced by the advocates of the milk diet is, that, on account of the inflamed and usually ulcerated condition of the small intestine in typhoid fever, liquid food should be given. They seem to forget that milk ceases to be a fluid the moment it reaches the stomach, and that all food which is properly prepared and digested reaches the ileum, the most common seat of greatest inflammation, in a more or less fluid form. In view of the latter fact it would seem that the food in typhoid fever only needs to be finely divided and digestible, and to be accompanied by a sufficient amount of water. E. K. Herring puts it rather aptly when he says, "It should be free from strings and stones and skins and bones."

It has been proved experimentally that the digestive and absorptive powers, during typhoid fever, fall off for only five to ten per cent, so that impaired digestion is not sufficient argument in favor of milk alone.

It has long been recognized that typhoid fever is a general infection, the bacilli having been found in practically all the tissues of the body; the intestinal lesions, therefore, are by no means the whole matter for consideration.

Curschmann's analysis of the causes of death in 580 cases of typhoid fever (Nothnagel: "Encyclopedia of Practical Medicine") shows: Severity of infection, 46.9 per cent; intestinal perforation, peritonitis, 16.5 per cent; hemorrhage, 7.8 per cent. Thus it may be seen that only a little less than half died from the severity of the infection, whereas a little less than one-fourth died from intestinal lesions. Taking these as representative figures, it is quite clear that we have twice as much to fear from the inability of the patient to withstand the severity of the infection, as we have from the intestinal lesions. It would seem equally clear, then, that the first indication is to maintain the bodily vigor at the highest point possible. It has also been suggested by Barrs (*British Medical Journal*, 1897) that starvation

would tend to prevent the healing of ulcers in the intestine, in the same way as in similar conditions in other parts of the body. It also seems likely that if the patient were allowed a greater variety of food during the febrile stage, there would be much less likelihood of bad results from indiscretions during early convalescence.

For several years I have been inclined to break through the ironclad rule of almost an exclusively milk diet; so very cautiously and with many fears and misgivings have I done so. So great has been the prejudice in favor of an absolutely liquid diet, as represented by milk with the occasional substitution of animal broth or tea, that the physician is almost afraid to take the risk of suggesting any change, knowing full well that, should anything go wrong he would be held responsible, if not by the patient and his friends, certainly by the profession, because of reckless feeding.

Since typhoid fever cannot be aborted, nor influenced by any form of specific medication, our efforts are directed toward so ordering the general conduct of the case as to avoid complications and to hasten recovery.

The trend of thought of the present day is toward the belief that most diseases are due to specific poisons, and that recovery depends upon, either the exhaustion of that poison, or the development of an antibody of some sort, which renders it innocuous.

It becomes necessary, then, to keep the patient in the best possible condition to withstand the ravages of the disease until such time as recovery shall take place.

Since many are exposed to typhoidal infection who do not develop the disease it is very evident that some have greater resisting powers than others, and it is probably due to this fact that we have not all had the fever. It seems reasonable to suppose that a long attack is due, in part at least, to the inability of the individual to overcome the poison. Therefore, we should do all we can to develop the resistive power, or in other words, to keep up the strength of the patient. To accomplish this end we must give sufficient food. Now it is almost impossible to give milk alone in sufficient quantity to supply the needs of a man through a long illness, even though it comes nearer to being a perfect food than any other article.

Voit's table shows that the normal man of an average weight of seventy-five kilos (150 to 165 pounds) doing a moderate amount of work requires a total food value of 3,000 calories per day to maintain the body in good physical condition. It has also been estimated that the body at rest requires 2,300 calories. Now the man suffering from typhoid fever would certainly require a larger food value than the man at rest because of the greater energy evolved in fever, if from no other

cause. This excess would be hard to estimate accurately, but it has been placed at 500 calories, which would bring the total food value requirement up to 2,800 calories, for a patient suffering from typhoid fever.

Now if 180 c.c. (six ounces) of milk, representing 200 calories, be given every two hours day and night, the total food value would, in twelve feedings be 2,400 calories; but few patients are wakened every two hours for food, so that nine feedings, at most, would be given, representing but 1,800 calories. Thus it is readily seen that the usual exclusive milk diet falls short by 1,000 calories, more than one-third of the supposed requirements.

Chittenden's experimental work in physiological economy has apparently proved that, so far as those in health are concerned, a food value of 2,000 to 2,500 calories, representing about half the nitrogenous food previously supposed to be necessary, is quite sufficient to maintain a perfect bodily and mental equilibrium. Of course this new scale rather throws doubt on all former calculations as to the bodily requirements in health and to some extent also in disease. But aside from all economic calculations it is well known that an exclusively milk diet, six ounces every two hours, does not satisfy the craving for food. We also have the most practical evidence of insufficient nourishment in those suffering from typhoid fever in their enormous loss in weight. Of course we recognize the fact that no matter how carefully we feed these patients there will surely be a loss in bodily weight, but it need not be so great.

In selecting a diet for typhoid fever patients the following important points should be borne in mind: It must be highly nutritious; it must be easily digested; it must be innocuous; it should be palatable. The food must possess sufficient nutritive value to maintain, as far as possible, the bodily equilibrium. Since the digestive functions are likely to be somewhat impaired, the food must be of such a kind and so prepared as to throw as little extra work upon them as possible. The food must be innocuous. Neither by its coarseness, bulky residue, gas-producing or other properties, should it tend to cause the serious complications of hemorrhage and perforation. Outside of the comfort and pleasure which palatable food affords the sick man, Pawlow has shown that it has an important bearing on its digestibility.

It has been my custom of late to begin the treatment of a case of typhoid fever, no matter on what day of the disease it may come under my care, with the regulation six ounces of milk every two hours, night and day while awake. Animal broths are given in place of milk, to vary the monotony for those who can take milk, and as a substitute for those who cannot. Each day, after the subsidence of the more

acute symptoms, such as headache, I ask the patient if he is hungry, and as soon as he replies in the affirmative a soft-boiled or poached egg is allowed, and if well borne, the number is gradually increased to three or more a day. The next additions are jelly or blancmange, custard, soft toast, the carefully selected soft part of baked apple, or rice which has been boiled four hours. The last to be tried are scraped beef or chop, very finely divided chicken and baked potato, the latter only when digestion seems specially good.

I do not want to be understood as advocating so full a diet in every case, but each case should be studied individually, and when, from the condition a more liberal amount seems advisable, it should be given.

I cannot but believe that most of the foods mentioned are quite as digestible, far more palatable, and less likely, if anything, to cause perforation or hemorrhage by their local action or gas production than milk. It is well known that milk often produces tympanites, that it leaves a large residue after digestion, and is more likely to cause impaction than almost any other food. Often in typhoid fever large curds are detected in the evacuations. It is then customary to reduce the already insufficient supply of milk by further dilution. Why not try something else?

Before analyzing my tabulated list I would like to call attention to one case whose unusual severity has materially raised the averages. This woman had fever for 97 days, was in bed 127 days, and in the hospital 135 days. Of course such a lengthy illness is uncommon, but it must be included.

In the deduction of averages I have disregarded small fractions as immaterial.

I wish to thank Dr. Homer Fuller, late resident at the Garfield Hospital, for having taken from my histories the data in this table.

Case No.	Day of Disease on Admission.	Day of Disease, Temperature Normal.	Day of Disease, Out of Bed.	Total Hospital Days.	Relapse.	Hemorrhage.	Delirium.	Highest Temperature.	Widal Reaction.	Complications.	Result.
No. 1	15	63	67	71	No	Yes	Yes	104.6	Pos.	Hem.	R.
No. 2	9	44	54	55	"	No	"	104.6	"	Delir.	R.
No. 3	3	31	40	50	"	"	No	104.8	"	No	R.
No. 4	2	32	40	49	"	"	"	103.8	"	"	R.
No. 5	5	45	61	63	"	Yes	"	105.6	"	Hem.	R.
No. 6	4	41	55	56	"	"	Yes	105	......	"	R.
No. 7	6	31	42	46	"	No	No	103.6	......	Pleur.	R.
No. 8	6	97	127	135	Yes	Yes	Yes	105	Pos.	Hem.	R.
No. 9	4	20	39	46	No	No	No	104	"	No	R.
No. 10	7	61	55	82	Yes	"	"	105.6	"	"	R.
No. 11	6	44	51	53	No	"	"	105.6	"	Pleur.	R.
No. 12	15	36	50	35	"	"	"	105	"	No	R.
No. 13	6	57	58	63	"	"	"	104.2	"	Osteom.	R.
No. 14	7	20	40	41	"	"	"	102.8	"	No	R.
No. 15	10	29	39	32	"	"	"	104.4	"	"	R.
No. 16	5	24	38	41	"	"	"	104.2	......	"	R.
No. 17	9	47	61	56	"	Yes	"	104.8	Pos.	Hem.	R.
No. 18	15	43	39	30	"	No	"	102.8	"	No	R.
No. 19	5	9	22	20	"	"	"	102.6	"	"	R.
No. 20	22	53	73	59	"	"	Yes	106	"	Delir.	R.
No. 21	6	11	23	18	"	"	No	104.2	"	No	R.
No. 22	8	16	30	27	"	"	"	103.4	"	"	R.
No. 23	3	24	39	48	"	"	"	104.4	Part	"	R.
No. 24	3	44	53	85	"	"	"	105.2	Pos.	"	R.
No. 25	3	38	48	45	"	"	"	104	"	Phleb.	R.
No. 26	1	51	61	81	"	"	"	104.2	"	No	R.
Average	7	39	50	50	2	5	5				

Of these 26 cases all recovered. The shortest duration was 9 days, the longest 97, the average 39; the earliest day on which a patient was out of bed was the 22d, the latest, the 127th, the average the 59th. The shortest stay in the hospital was 18 days, the longest 135, the average 50.7. (The last figures, relating to the number of days in the hospital, are of no value, as the date of admission was in some cases very late, while others left before they were completely recovered.) There were two relapses; in five cases one or more hemorrhages occurred, but in only one instance, as it happened, had an exclusively liquid diet been exceeded before the occurrence of hemorrhage. Delirium was present in five cases. Other complications were not more numerous than usual except pleurisy, which was twice recorded.

While I know that twenty-six cases form far too small a number from which to draw conclusions of any great value, yet it is my belief

that the careful personal observation of even a few cases should be recorded, for it will require the weight of evidence of many clinicians to shake the implicit faith of the profession in the exclusive milk diet.

From my own experience I am prepared to say that the more liberal diet is certainly not deadly; if it possesses no special advantages neither does it show special disadvantages. The advocates of the more liberal diet, among whom I take my stand, claim that the patient is more comfortable; that the attack is slightly shortened; that convalescence is more prompt, and that neither relapse, hemorrhage, nor perforation is more frequent.

The advantage which is most apparent is the increased comfort of the patient. Typhoid fever is at best long and tedious, and we are all familiar with the days and weeks during which our patients clamor for more to eat. The pangs of hunger are much harder than many other discomforts that they are called upon to bear after the first ten days of fever. Now if more liberal feeding does no harm this one advantage—the comfort of the sick man—is sufficient argument in favor of its adoption, but more is claimed.

F. C. Shattuck (*Boston Medical and Surgical Journal*, Vol. 148, 1903) reports a mortality of 10 per cent. in 233 cases on an exclusively milk diet, while the mortality was but 8.45 per cent. on an enlarged diet. Fitz's analysis of the cases of typhoid fever in the Massachusetts General Hospital (*Boston Medical and Surgical Journal*, 1899) shows that the mortality was less in Shattuck's cases, on a more liberal diet, than in those of his colleagues, on a milk diet; and that relapses were 2.9 per cent. less frequent in the liberally fed. W. H. Smith has brought these statistics up to 1902, and shows that in 563 cases, hemorrhage, perforation, and relapse were no more frequent among the more liberally fed.

Shattuck's diet list is about as follows: Minced lean meats, scraped beef, soft part of raw oysters. Soft crackers with milk or broth, soft puddings without raisins, soft toast without crust, blancmange, wine jelly, apple sauce, and macaroni.

Of course the way to become convinced is to try the system, but those who are interested will find instructive articles, besides those already mentioned, by Marsden (*The Lancet*, January, 1900), the late F. A. Packard (*Therapeutic Gazette*, 1900), Murrell (*Medical Brief*, St. Louis, 1900), Morris Manges (*Medical Record*, 1900), and H. A. Hare (*Therapeutic Gazette*, 1904). The latter states that his attention was first called to this matter by an attack of typhoid fever, during which, though he had no appetite, yet he felt underfed. He felt that he was attacked on the one hand by the bacillus of Eberth and on the other that his powers of vital resistance were being reduced by partial star-

vation. Two of the most thoughtful articles on the subject are by J. B. Nichols (*American Medicine*, Vol. 9, No. 18, and *Medical Record*, 1905). Thayer's translation of Bushuyev's article has attracted wide attention, and although the latter's results were excellent, I am not yet, nor do I ever expect to be ready to advise such a diet for typhoid fever patients as he advocates. It is rather too much on the order of that for a day laborer.

It is far from my intention to speak ill of the bridge which has carried so many safely over, and indeed, from long experience, I have a most wholesome respect for the milk diet in typhoid fever, but I do believe that the pendulum is making a belated swing toward more liberal ideas with regard to feeding.

CIRRHOSIS OF THE LIVER WITH REPORT OF A CASE.

By Thomas S. D. Grasty, M. D., Assistant Professor of Bacteriology and Pathology.

Since 1514, when Versalius, followed by Harvey and Morgagni, first described the hardened condition of the liver, now known as cirrhosis—a term given by Laennec in 1819, who regarded the bile-stained hob-nails as masses of yellow new growth invading the liver, but now known to be islands of liver cells encircled and compressed by surrounding bands of contracting fibrous tissue—many and diversified attacks have been made upon this type of disease and its relation to the human organism. The subject of hepatic cirrhosis is, indeed, vast and is one on which a great deal has been written. Extensive experimental work performed in recent years has changed many of our views both regarding the prognosis and treatment of this disease.

Portal cirrhosis, a disease of late middle life, and usually proves fatal at about fifty years of age, is more common in men than women in about the proportion of five to two.

Experiment has shown that a large number of poisons are capable of giving rise to changes in the liver comparable to those of cirrhosis (often it is true, the lesions are early or at the best not well marked). But the facts are of value as indicating that cirrhosis in man may reasonably be considered as the result of a toxic process. The poisons may be absorbed from the alimentary canal and reach the liver in a comparatively concentrated form or they may travel to the liver by the hepatic artery, in this later event the dose being comparatively dilute as compared with the former. Ordinary cirrhosis in man is generally due to poisons traveling by the portal vein.

Alcoholism is rather an antecedent condition than a "causa vera" and acts indirectly or in an accessory manner, though in ordinary practice the association between cirrhosis and antecedent alcoholism is of fundamental importance; although it is well known that among the Brahmins and other high-cast Hindus, who, as a rule, lead abstemious lives and never touch alcohol, cirrhosis of the liver is of frequent occurrence. The possibility of cirrhosis being definitely due to micro-organisms is one that must be faced; from analogy it is most probable, but at present, as in the case of syphilis it has not been certainly established. It is also highly probable that poisons, or perhaps micro-organisms, reaching the liver by the hepatic artery may give rise to changes of a cirrhosis nature.

As regards the nature of cirrhosis it is in the present state of our

knowledge safest not to regard the cirrhotic process as exclusively due either to irritative hyperplasia of the connective tissues, the hepatic cells being quite passive on the one hand, or to primary degenerative or atrophic changes in the hepatic cells with a resulting replacement fibrosis on the other, but to remain content with the view that the irritative poisons leading to cirrhosis affect both elements in different ways and that the resulting change in one tissue may further initiate fresh changes in the other tissue or modify those already existing.

Many classifications have been introduced both clinically and histologically as portal, biliary, hypertrophic, multilobular, mono-lobular, pericellular mixed and sporadic each with many sub-divisions indicative of the most marked changes. These I shall not enter into. Suffice it to say that the size of the liver in ordinary cirrhosis may vary greatly from 30 to 150 to 200 ounces, and it is noteworthy that a cirrhotic liver, which is actually smaller than normal, often weighs as much as a healthy liver, or even more, its specific gravity being much increased. There are also many changes occurring in the gall-bladder, bile-ducts, portal vein, spleen esophagus, stomach, small intestine, pancreas, kidneys, with many associated lesions, it being an established fact that tuberculosis is met with in the bodies of patients with cirrhosis more often than in other non-tuberculous diseases, together with chronic peritonitis, arteriosclerosis, heart conditions, carcinoma, et cetera.

Some writers have spoken of hepatic cirrhosis as a disease which is not strictly limited to the liver but is a part of a general change and in this respect it might be compared to the condition of red granular kidneys, which is a local manifestation of a general vascular change, arteriosclerosis. Portal cirrhosis might in the same way be considered to be a part of a general change in the alimentary system, for the spleen, the intestines and the pancreas commonly show changes in hepatic cirrhosis. Some of the changes are secondary to portal obstruction, but this does not account for the visceral changes and some of them must be regarded as concomitant effects of a general cause, in many cases, alcoholism. As bearing on this conception of cirrhosis as a part of a widespread change in the alimentary system, Klippel and Lefac have pointed out that, in some instances of cirrhosis the changes may be more advanced in the pancreas than in the liver. The secondary relation of cirrhosis to a general cause is also seen in hemochromatosis, where, as a secondary result, cirrhosis of the liver and pancreatic fibrosis may occur.

The course of ordinary cirrhosis may be divided into:—First, the early pre-ascitic stage; second, the late or asitic stage.

The early stage begins vaguely and gradually; the symptoms are mainly those of dyspepsia, often of an alcoholic nature, with loss of appetite and gastro-intestinal disturbances. Epitaxis may occur now and then, but the

most important event in the early stage is the occurrence of hematemesis. The liver is generally somewhat enlarged and slightly tender, chiefly due to vascular engorgement.

In the late stage, usually some months or years may elapse before ascites develops. The disease may become latent from the development of compensatory processes. The development of ascites may come on suddenly and when occurring the patient has undergone considerable amount of wasting and shows marked muscular debility. The wasting of the temporal and facial muscles gives a characteristic appearance to the patient, the atrophy of the thoracic muscles shows up in marked contrast to the swollen abdomen, the skin becomes harsh, dry, loses its elasticity, petechiae may develop, while there may be hemorrhage from the various mucous membranes and oozing from the gums. This feature was present to a marked degree in the case which I shall present, his pillow being soiled with bloody mucoid discharge.

The ascites may require tapping once, twice or even oftener, but all authorities agree that in cases of cirrhosis uncomplicated by chronic peritonitis paracentesis is seldom required more than once. (In this respect I would say that the case that I shall report has given no indication of such a condition. Yet, paracentesis has seemed imperative twenty-one times.) The patient emaciates rapidly, loses strength, becomes stupid, drowsy, or even delirious. I should like to emphasize the nervous symptoms, as my patient exhibited them during the course of his disease to a marked extent. During two exacerbations the urine was much diminished, and with the development of slight fever the patient exhibited signs closely simulating cerebral uraemia, intense headache, amaurosis, noisy delirium with resulting stupor, following which for several weeks there remained slow cerebration with some loss of memory.

Portal cirrhosis commonly lasts a considerable time, one, two or more years, usually intervening before the appearance of symptoms due to the liver, if, indeed, their first appearance can be accurately described, and with the exception of Flint, all authorities agree that when acites has developed death usually follows before the patient requires tapping more than twice, unless complicated, as before stated, with some degree of chronic peritonites.

As regards the relief of portal cirrhosis, many remedies and methods have been devised, all having for their object the establishment of a collateral or compensatory circulation. I shall only call your attention to the more recent surgical treatment. The operation of paracentesis is a very simple one with the ordinary surgical technique now at our command and should, in my opinion, be used early, as it is productive of only good results when properly done.

With reference to the more recent surgical treatment, I refer to Talma's operation, or the treatment by the production of vascular peritoneal adhesions. This method, as devised by Drummond and Morrison, was based on the assumption that ascites was due to portal obstruction and was an attempt to increase the collateral circulation between the radicles of the portal vein and the general systemic circulation. The operation was original in Morrison's hands, but it appears that it had been previously planned by Talma and carried out by Vonder Menlen in 1889, Schelkley in 1891, and Leus in 1902. The operation consists, after paracentesis and with the usual technique, in making an incision parallel to the right costal margin, the peritoneum over the liver and diaphragm is scraped or curetted, so as to set up adhesive inflammation and the surfaces are brought together by stitching the round ligament to the abdominal parietes, or by passing stitches through the liver itself. Whether or not the improvement which sometimes results both in the general health and in the local condition simply depends on the collateral circulation relieving the pressure in the portal vein or not, has not been decided, though it appears to me that there are at least two other ways in which the establishment of a collateral circulation in the adhesions around the liver may be of benefit. First, by diminishing the flow of blood through the liver it may enable this organ to deal more satisfactorily with the blood passing through it and so reduce its toxaemic condition. Second, that the presence of vascular adhesions over the surface of the liver would relieve venous engorgement and so allow a freer supply of arterial blood.

As regards the ultimate results of this operation I can only present a few statistics: Kolmskie (1904) collected 168 cases; 46 per cent cured or improved, 49 per cent unimproved, 5 per cent unknown.

Burns (1902) collected cases during the preceding five years; 37 per cent. mortality, 10 per cent. cures, 20 per cent. markedly improved.

In 105 cases collected by Greenough only nine showed improvement after two years.

The history of the case which I wish to present is as follows and exhibits the following unusual features: (1) Long duration of the disease; (2) Number of times paracentesis was required; (3) Apparent recovery of general health with disappearance of ascites for over one year.

E. Y., age 48, American, male, residence Washington, D. C., clerk in Government office.

FAMILY HISTORY. Paternal.—Grandfather died suddenly at age of fifty-seven. Grandmother died suddenly of heart disease, age thirty-nine. Maternal—Grandfather dropped dead in January 1888, age seventy-seven. Grandmother died aged eighty, from general asthenia. Parents—Father died at thirty-one years of age from pneumonia. Mother living, has had some cardiac disturbance for years. One sister died of measles, age three years, one brother died when an infant; one sister living, some cardiac disease, very neurotic temperament; another sister living, suffering from neurasthenia.

PREVIOUS HISTORY.—Birth normal, breast fed, usual diseases of childhood, measles, typhoid fever, etc. Began school at six years, mental development normal. Health during youth and early life good, user of tea and coffee, tobacco not used in any form, alcohol used constantly during past fifteen years with numerous excesses, to great excess during one year. Alcohol not used in any form since July 1903. Denies any specific history.

HISTORY OF PRESENT ILLNESS.—First symptoms noted October, 1900, when he began to suffer with signs of a chronic gastric catarrh, anorexia, furred tongue, bowels irregular, constipation alternating with diarrhoea, together with some bleeding from gums. Was compelled to go to bed and was unable to perform his daily duties for about three months. Had some abdominal tenderness, distention, was treated by a physician with drugs and the local application of an ointment and condition improved so that he returned to work. Though advised strongly at that time to give up alcohol, patient returned immediately to its use. From February, 1901, to June, 1903, enjoyed fair health, with two attacks of vertigo, falling upon the street during periods of excessive drinking.

In June, 1903, I was called to see him and found his condition at that time as follows: Height, about 5 feet 8 inches. Weight, about 140 pounds. Dorsal decubitus, head raised rather high on pillows. Facial expression dull, intelligent. Body much emaciated, muscles wasted, especially those of face, temporals markedly so, muscles of throacic wall much atrophied, bones prominent, no deformities, ankles slightly swollen. Skin sallow, muddy, dirty in appearance, no discoloration of conjunctivae. Skin over face drawn and thin and shows several clusters of dilated vessels, or stigmata, one on forehead particularly prominent, some also present over lower limbs, stellate in appearance. Skin dry and harsh over rest of body, except over abdomen where veins are distended and skin drawn, shiny and tense. Hair scanty and dry, glands (superficial) not perceptibly enlarged. Has post nasal catarrh with much mucus dropping back into posterior pharynx, expectoration at times, blood tinged, no bronchial cough, lungs apparently normal, with exception of few moist rales over bases posteriorly, respirations increased, rather labored and panting. Heart rapid, no murmurs, pulse regular, though weak, apex beat slightly higher than normal. Lips dry, pale and fissured gums red and spongy, bleeding upon slightest pressure, tongue flabby, furred and dry, slightly tremulous. Throat shows evidence of chronic congestion, deglitution normal. Appetite very poor, thirst excessive, vomits at times, with much mucus. Intestinal digestion poor, bowels sluggish. Temperature 99.6 F. (mouth.)

The physical examination of the abdomen shows abdomen greatly enlarged, measuring 48 inches in circumference, enlargement uniform, umbilicus protruding, tense and shining. Movable dullness over flanks, resonance over umbilicus, distinct wave and thrill felt on palpitation. On deep respiration edge of liver felt distinctly from 2 to 2 1-2 to 3 inches below costal margin, spleen not palpable, veins in region of umbilicus distended. Nervous system negative with exception of some headache and extreme depression. Vision fair, wears glasses, conjunctivae very pale, vessels much distended and injected. Other special senses normal. Kidneys seem to be functionaling normally, urine high colored, contains slight trace of albumen, no casts. Genitals much atrophied.

PROGRESS OF CASE.—During first few days after my first visit the patient drank large quantities of alcohol, followed by acute delirium, fever, slight jaundice and a marked diminution in the amount of urine which became very dark and high colored. On July 6, '03, paracentesis was performed and about 3 1-2 to 4 gallons fluid removed. Since then to August, 1904, patient was confined to house and bed and was tapped twenty-one times. The intervals at first being from three to four weeks. When distention was marked there

would occur some degree of stupor, marked edema of feet, legs and testicles, becoming so great on one occasion as to require multiple incisions in skin with pressure bandages, appearance of hemorrhoids; jaundice never a marked feature, though skin would become slightly icteroid, frequent hemorrhages from gums and throat, some petechial spots over body, with the development of a laryngeal cough, raising much mucus, often bloody in character. After several successive tappings it was found that the liver was decreasing in size, encroaching on the costal margin. During attack of fever mental condition would become very bad, some low muttering delirium with loss of memory, and a desire to repeat the same question, word, or phrase again and again.

During his illness he was seen by three other physicians with me in consultation, all of whom agreed with the diagnosis already made and gave a very unfavorable prognosis. One of them advised that if his general condition did not rapidly improve that a Talma-Morison operation should be done, this, however, was not agreed to by his family.

Since August, 1904, his condition has steadily improved, the ascites never recurring, emaciation, still marked, appetite good. He now spends much of his time in walking and being out of doors.

The ascitic fluid removed gave the following analysis:

(1.) Yellowish color.

(2.) Almost clear, at times slightly bile stained alkaline.

(3.) Specific gravity 1.015.

(4.) Much albumen.

(5.) When placed upon culture media no growth occurred.

(6.) Microscopic examination shows few mono-nuclear lymphocytes.

His physical examination at present shows the existence of no heart murmurs, liver cannot be felt, urine free from albumen and casts, abdomen slightly swollen, measuring now 34 inches. The right side of scrotum much larger than left, though testicles easily felt and is about same size as left.

As regards treatment, he has been given all treatment that I had at my command, purgatives, diuretics, diet, potassium, iodide, Neimeyer's pill, etc., the most satisfactory proving to be magnesium sulphate each morning before breakfast, given in as little water as possible.

Is the patient cured? It is difficult to say that any case is cured, but here is a man, on the point of death from a disease well known as commonly being deadly in its effects, who, after submitting to a certain line of treatment, ceases altogether to show a most dangerous symptom, and rapidly recovers flesh and strength.

Dr. McDonald (in Medical News, 1889) reports a case aspirated 31 times with the removal of 8,600 to 9,000 ounces of fluid, dating from May, 1888, to August, 1889, with apparent disappearance of symptoms and regaining health.

The conditions necessary for such a favorable result are, first, the patient must be comparatively young and his vessels in condition to accommodate themselves to new conditions. And, second, there must be no disease of heart, lungs or kidneys.

In conclusion, I would say that the following features are those to which I would like to call attention as most pertinent in my diagnosis:

(1) age; (2) strong alcoholic history; (3) history of dyspepsia; (4) primary enlarged liver; (5) secondary contracted liver; (6) hemorrhages; (7) ascites; (8) jaundice not marked.

THE RELATION OF MEMBERS OF THE FACULTY OF THE GEORGE WASHINGTON UNIVERSITY TO YELLOW FEVER INVESTIGATIONS.

By H. H. Donnally, A.M., M.D., Instructor in Bacteriology and Pathology.

When the Army Medical School was established in Washington in 1893, Major Walter Reed, of its faculty, was made Professor of Bacteriology and Pathology in our University. This position he filled with credit until his death, nine years later, and many of our alumni, including the writer, remember Dr. Reed with peculiar pride and gratitude because of the personal relation of teacher and student which existed between them.

Dr. James Carroll was elected Assistant Professor at the same time with Dr. Reed, and, upon the latter's death, was made Professor of Bacteriology and Pathology, his present chair. Surgeon-General George M. Sternberg, U.S.A., retired, holds the chair of Preventive Medicine in this University.

In view of the great achievements of these men of science and their vital association with this University, it seems appropriate that the subject of this paper be discussed in The University Bulletin.

The first Havana Yellow Fever Commission was sent to Cuba in 1879. Dr. George M. Sternberg, U.S.A., who for years made systematic investigations into the etiology of yellow fever by bacteriological methods, was a member and secretary of this commission. Sternberg worked independently also in Vera Cruz, Rio de Janeiro, New Orleans and other southern ports. When made Surgeon-General, Dr. Sternberg was obliged to abandon his test tubes and microscope, his task unfinished, but his interest in it unabated, while he had as a result of his work Bacillus X recovered at autopsy from about half of the bodies dead of yellow fever, examined by him. The remarks of Prof. W. H. Welch, of Baltimore, at the banquet in New York City in honor of General Sternberg upon the latter's retirement in 1902, present authoritatively an estimate of Sternberg's work. As reported in Medical News, June 21, p. 1198, of that year, Dr. Welch said that "his work with yellow fever would stand forever. He said it was a common thing in these busy days to forget the steps which led up to any important discovery. All that Dr. Sternberg had done in the study of yellow fever was necessary work and it had to be done in just the way that he did it. The ground had first to be cleared; if it were not so the discovery had not been possible, and later discoverers themselves would have had to hunt out the large host of micro-organisms which Dr. Sternberg had described and laid aside. Dr.

Welch said that his careful work had practically resulted in the view that a bacteriological origin for this disease could not be claimed, and it was on *a priori* grounds that he himself had felt that Sanarelli's bacillus was not the cause of yellow fever. His study of others' discoveries was most careful and most critical; it was not wasted endeavor."

With such a scientist as head of the medical department of the army, it is easy to understand how in the summer of 1897 Major Reed and Dr. Carroll were assigned the work of investigating Bacillus X (Sternberg) and "Bacillus icteroides," the latter recently declared by Sanarelli in the *Semaine Medicale* (Paris, 1897, xvii, 253-255) to be the specific cause of yellow fever. These medical officers were especially qualified to undertake such a study by the nature of their work in the Army Medical School in Washington, and by special post-graduate laboratory work at Johns Hopkins Hospital,—Reed in 1890-91, when he studied pathology and bacteriology; Carroll studying pathology there in 1891-2, and bacteriology the following year, 1892-3.

The results of their work with these two organisms proved that Sternberg's Bacillus X was an atypical colon bacillus, that B. icteroides (Sanarelli) was a member of the hog cholera group, and that neither one of them bore any causal relation to yellow fever. These conclusions absolutely refuting Sanarelli and others regarding this micro-organism were published by Reed and Carroll.*

About one year before the appointment of the present Army Yellow Fever Commission, *Medical News*, April 29, 1900, comments editorially upon the question, "Is Sanarelli's Bacillus Icteroides the Cause of Yellow Fever?" The "Preliminary Note" of Reed and Carroll's investigation of this organism is there reviewed. The editorial concludes, "There remains open for ambitious American bacteriologists a very interesting problem of etiology (of yellow fever) whose study the United States' possession of Cuba and Porto Rico will greatly facilitate and whose importance can scarcely be overestimated. Any discoveries in this matter will confer lasting fame upon the investigators."

Some time after the above there was issued from the Government Printing Office the "Report of Medical Officers Detailed by Authority of

*(1.) Medical News, N. Y., April 29, 1899, "Bacillus Icteroides and Bacillus Cholerae Suis. A Preliminary Note." Walter Reed and James Carroll.

(2.) Medical News, September 9, 1899, "A reply to Dr. G. Sanarelli." Walter Reed and James Carroll.

(3.) Proceedings American Public Health Association, Oct. 1900. "The Etiology of Yellow Fever. A Preliminary Note." Reed-Carroll-Lazear-Agramonte.

(4.) Journal of Experimental Medicine, December, 1900, (Received for publication Feby. 25, 1900), "A Comparative Study of the Biological Characters and Pathogenesis of Bacillus X (Sternberg), Bacillus Icteroides (Sanarelli), and the Hog Cholera Bacillus (Salmon and Smith)." Walter Reed and James Carroll.

the President (McKinley) to investigate the Cause of Yellow Fever," by Drs. Eugene Wasdin and H. D. Geddings, of the Marine Hospital Service. The first of an elaborate set of conclusions published in this lengthy report, is: "That the micro-organism discovered by Prof. Guiseppe Sanarelli, of the University of Bologna, Italy, and by him named 'Bacillus icteroides,' is the cause of yellow fever."

On June 25, 1900, the Board of Army Medical Officers, Major Walter Reed, Drs. James Carroll, Jesse W. Lazear and Aristides Agramonte, appointed upon the recommendation of Surgeon-General Sternberg to investigate "the acute infectious diseases prevalent in the Island of Cuba," assembled at Quemados, Cuba, and at once set about their study of the cause and means of preventing yellow fever. For the first few weeks they made cultures from the blood of living cases of yellow fever and from the blood and organs at autopsies upon cases of this disease. "Bacillus icteroides" was not recovered by them in a single instance, whence they conclude:

"1. Bacillus icteroides (Sanarelli) stands in no causative relation to yellow fever, but, when present, should be considered as a secondary invader in this disease."

While these bacteriological investigations in Cuba were in progress, the board were discussing the mosquito as a possible agent for the transmission of the disease. Nineteen years previously this theory had first been advanced by Dr. Carlos J. Finlay, of Havana, who wrote and experimented persistently upon it after his first announcement. The season and the manner of spread of a yellow fever epidemic; the work of Ross and others upon malaria and its mosquito transmission; Finlay's theory; the observations of Carter upon the length of time between the arrival of the infecting case and the appearance of the secondary group of infected cases; these, together with their own observations after their arrival in Cuba, are mentioned by the board as factors leading them to determine to test to a conclusion the mosquito theory.

It is to be borne in mind that Dr. Agramonte was stationed and working in Havana, while Drs. Reed, Carroll and Lazear were quartered in Columbia Barracks, near Quemados, and the seat of their principal work. Here the members of the board working at first to produce further evidence, which they did not think was needed, to refute Sanarelli, Wasdin and Geddings, and a few others, were working out in their daily intercourse and discourse in the laboratory, at table, and elsewhere, the best plans for future procedure. It was the board as a whole (excepting Agramonte) which first formed the conclusion to investigate the mosquito theory.

"The line of work being finally determined, there at once arose the tremendous responsibility involved in the use of human beings for experi-

mental purposes. After careful consideration, the Commission reached the conclusion that the results, if positive, would be of sufficient service to humanity to justify the procedure, provided, of course, that each individual subjected to experiment was fully informed of the risks he ran, and gave his free consent. The members of the Commission, however, agreed that it was their duty to run the risk involved themselves, before submitting anyone else to it.

"It became necessary just at this time for Dr. Reed to return to this country and the experiments were begun by Dr. Lazear." ("Walter Reed and Yellow Fever," p. 131-132, H. A. Kelly.)

When Major Reed left Cuba, August 4, 1900, (Kelly) Carroll and Lazear began to carry out the work agreed upon by them and Reed as described above by Dr. Kelly; Agramonte was intentionally kept in ignorance, by direction of Dr. Reed, of this plan of investigation. Dr. Finlay furnished them with mosquito eggs of the genus with which he had been experimenting. These were hatched and the adult mosquitos were infected by Dr. Lazear applying them to cases of yellow fever. He applied his infected mosquitos then to nine healthy non-immunes including himself, but all failed to develop the disease either because the mosquitos had not been kept sufficiently long after their infection or because they were applied to the yellow fever patients too late in the disease. On August 27, 1900, however, Dr. Carroll bared his arm in the laboratory and allowed Dr. Lazear to apply to it a mosquito which had twelve days before bitten a severe case of yellow fever on the second day of the disease, and had thereafter bitten three other cases at intervals of 6, 8 and 10 days. The following is taken from the "Preliminary Note" read before the Public Health Association in 1900:

"Of the two cases which we have recorded as positive in Table III, we now propose to speak at greater length.

Case 10. Dr. James Carroll, Acting Assistant Surgeon, U. S. Army, a member of this board, was bitten at 2 p. m., August 27, 1900, by Culex fasciatus. This particular mosquito had bitten a severe case of yellow fever on the second day of the disease 12 days before; a mild case of yellow fever, on the first day of attack, 6 days preceding; a severe case of yellow fever, on the second day of the attack, 4 days before, a mild case of yellow fever on the second day of attack, 2 days before inoculation.

Dr. Carroll remained well unt'l the afternoon of the 29th, when he states that he felt tired and for this reason, when on a visit to Las Animas Hospital, the same afternoon (29th), sometime between 4 and 6 p. m., after visiting a few patients, he left the wards and waited outside on the porch, while his companions remained in the wards.

August 30th. During the afternoon, although not feeling well, Dr. C. visited La Playa, distant about one and a half miles from Columbia Barracks, and took a sea-bath.

August 31st., A. M. Dr. C. realized that he was sick and that he had fever, although he refrained from taking his temperature, but did visit the labora-

tory, distant about one hundred and forty yards, for the purpose of examining his blood for the malarial parasite. The examination was negative. During the afternoon he was compelled to take to his bed. At 7 p. m., temperature was 102 degrees F. No headache nor backache; only a sense of great lassitude. Eyes injected and face suffused.

September 1st, 7 A. M. T. 102 degrees F. Blood again carefully examined by Dr. Lazear with negative result. 11 a. m., T. 102 degrees.

The case having been diagnosed as one of yellow fever, Dr. C. was at noou removed to the yellow fever wards.

9 p. m., T. 102.8 degrees, pulse 90; 12 o'clock, midnight, T. 103.4 degrees, pulse, 84.

September 2d, 8 A. M. T. 103.6, pulse, 80. A trace of albumen was now found in the urine. The subsequent history of the case was one of severe yellow fever. Jaundice appeared on September 3d.

The accompanying chart No. 1 contains all of the necessary data."

Thus in the person of Dr. Carroll was given the first demonstration that the mosquito conveys the infective agent of yellow fever. For three days his life hung in the balance,—a rather anxious time for his wife and children (five) in Washington, who were, through the courtesy and kindness of Surgeon-General Sternberg, kept informed by the daily cable reports to him.

Dr. Reed, in Washington during this anxious and critical period, was most solicitous as to Carroll's welfare.

On August 31, four days later, with the same insect with which Dr. Carroll was brought down, and three other mosquitoes, Dr. Lazier infected a private soldier who passed through a mild attack of the disease.

The sad martyrdom of Lazear occurred on September 25, 1900, after an illness of one week with yellow fever brought on by the bite of a stray mosquito in the yellow fever ward where he was engaged infecting mosquitos for his experimental work, by allowing them to bite yellow fever patients. Although he had previously allowed himself to be bitten by an infected mosquito, he failed to develop the disease in consequence of it. It was accidental rather than a part of the program that he was bitten as he was. In the President's address, American Public Health Association, 1902, Dr. Henry D. Holton, says: "The patriotism of the military as they spring to the defense of their country, always deserves and receives the applause of the populace. Their deadly conflict on the battlefield is made easy by martial music, the booming of artillery, the rattle of the infantry fire, and the advancing step of comrades. How much more should we recognize the course of such devotees of science as Dr. James Carroll and Jesse W. Lazear, who, filled with a great philanthropic love for humanity, calmly, quietly, without the cheers or even the knowledge of the multitude, silently submitted themselves to the test to determine in what way this pestilence was communicated. We are told, 'Greater love hath no man than this, that a man lay down his life for his friend.' We find that Jesse W. Lazear, fired and impelled by his great

love for his fellow man, did offer his body as a sacrifice upon the altar of scientific investigation, to the end that in the years to come hundreds of thousands might escape this pestilential death. * * * * * * *

"The practical result of all this work and sacrifice has been evidenced this past summer; not a case of yellow fever has originated in Cuba for the past fourteen months, the quarantine period has been shorter by three months; thousands of lives and millions of treasure have been saved and a feeling of security has filled the communities of the southern portion of our country."

In McClure's, June, 1906, Samuel Hopkins Adams, in an article entitled, "Yellow Fever; A Problem Solved," says:

"Lazear died, a martyr to humantiy, and is remembered by one where the lesser heroes of our Cuban battlefields are acclaimed by thousands. Carroll barely escaped with his life, and Reed, shrinking from no peril which his companions braved, came through unscathed by virtue of some natural immunity, only to die of another illness the following year."

The apparent inference of this statement is that Dr. Reed was intentionally bitten by an infected mosquito. There is no published record of such inoculation. As a matter of fact, mentioned above, Dr. Reed was in the United States while, in August and September 1900, Carroll and Lazear demonstrated by experiment in Cuba that the mosquito conveys the disease. Doubtless Dr. Reed would have willingly submitted himself had he been in Cuba at the time.

Dr. Reed returned to Cuba early in October (Kelly), and, after reviewing the experiments conducted during his two months absence, reported at Indianapolis, October 22-26, 1900, before the American Public Health Association, the "Preliminary Note" referred to above. the second conclusion of which was:

"2. The mosquito serves as the intermediate host for the parasite of yellow fever."

In order to recuperate, Dr. Carroll now returned home on leave of absence until about the middle of November, 1900.

On November 20, 1900, Camp Lazear, so named in honor of their dead colleague, was established near Quemados by the Commission for the purpose of confirming and continuing their work with yellow fever and the mosquito. Inoculation experiments with mosquitos and with yellow fever blood, and experiments with fomites followed in a most brilliant and well considered series until the latter part of February, 1901, and furnished the basis of several reports * by the Commission, which extended and rounded out their work and established their claim.

* "The Etiology of Yellow Fever. An Additional Note." Reed, Carroll and Agramonte. Journal American Medical Association, February 16, 1901.
"Experimental Yellow Fever." Reed, Carroll and Agramonte, American Medicine, July 6, 1901.
"The Prevention of Yellow Fever," Reed and Carroll. Medical Record, October 26, 1901.

In the "Additional Note" (see foot note) the following are the published conclusions:

"1. The mosquito—C. fasciatus—serves as the intermediate host for the parasite of yellow fever.

"2. Yellow fever is transmitted to the non-immune individual by means of the bite of the mosquito that has previously fed on the blood of those sick with this disease.

"3. An interval of about twelve days or more after contamination appears to be necessary before the mosquito is capable of conveying the infection.

"4. The bite of the mosquito at an earlier period after contamination does not appear to confer any immunity against a subsequent attack.

"5. Yellow fever can also be experimentally produced by the subcutaneous injection of blood taken from the general circulation during the first and second days of this disease.

"6. An attack of yellow fever, produced by the bite of the mosquito, confers immunity against the subsequent injection of the blood of an individual suffering from the non-experimental form of this disease.

"7. The period of incubation in thirteen cases of experimental yellow fever has varied from forty-one hours to five days and seventeen hours.

"8. Yellow fever is not conveyed by fomites, and hence disinfection of articles of clothing, bedding or merchandise, supposedly contaminated by contact with those sick with this disease, is unnecessary.

"9. A house may be said to be infected with yellow fever only when there are present within its walls contaminated mosquitos capable of conveying the parasite of this disease.

"10. The spread of yellow fever can be most effectually controlled by measures directed to the destruction of mosquitos and the protection of the sick against the bites of these insects.

"11. While the mode of propagation of yellow fever has now been definitely determined, the specific cause of this disease remains to be discovered."

In the report entitled "Experimental Yellow Fever" the board recites the clinical features of the disease as manifested in their experimentally infected cases. In "The Prevention of Yellow Fever," the Stegomyia fasciata is described, its appearance, habitat, breeding places, mode of life, and so on, together with methods for its control and suppression. Dr. John Guiteras (American Medicine, November 23, 1901, p. 809) confirmed the infected mosquito work by producing eight cases of yellow fever by this means in Havana; three of them proved fatal.

This brings the work of the Commission up to the summer of 1901, when Agramonte was relieved, and Carroll was again sent to Cuba, this time alone, "for the purpose of continuing the investigation into the causa-

tion and prevention of yellow fever." During August, September and October of 1901 he conducted experiments which showed that the specific agent of yellow fever will pass through a Berkefeld filter so fine as to prevent the passage of the smallest bacteria. He further proved that partially defibrinated blood heated to a temperature of 55 degrees C. for ten minutes loses its infectiousness. He autopsied a case of Dr. Guiteras', which was the first fatal case of yellow fever experimentally produced, and found the lesions to be identical with those in non-experimental yellow fever. Dr. Reed writes to him, October 26, 1901, in reply to a letter summing up his summer's work:

"My Dear Doctor:

"I have just received your letter of the 22nd and hasten to congratulate you on the thorough manner in which you have accomplished the task assigned you. The results could not be better and throw a flood of light on the Etiology of Yellow Fever. * * * * We can now go ahead and submit a contribution on the etiology of yellow fever. This we must do promptly after we have discussed all of the later results. * * *

"Again, congratulations. Hoping to see you back soon,

"Sincerely yours,

"W. REED."

The next report * of the Commission was the "Supplemental Note," which described the work of Carroll last referred to.

All of the results of the American Commission have been amply confirmed, among others by the U. S. Marine Hospital Service at Vera Cruz, and in Brazil by a Commission from the Pasteur Institute, published in November, 1903. †

During the next year no new results were accomplished, their search for the specific organism in the bodies of infected mosquitos, sectioned and mounted, being unavailing, as it had been before in their studies in Cuba of mosquitos dissected in the fresh state; also from prolonged study of the blood of yellow fever patients, made by all of them, especially by Carroll, from the very beginning of their investigations.

In the fall of 1902, with slowly failing health, Reed suffered an attack of appendicitis, which resulted six days after operation in his death, November 22, 1902. His death was widely noted, especially by scientific bodies throughout the world, and his loss universally mourned.

There remained now but one member of the Commission, James Carroll, who since the death of Major Reed, has never been relieved from

*"The Etiology of Yellow Fever. A Supplemental Note." Reed and Carroll. American Medicine, February 22, 1902.

†"La Fievre Jaune," by M. M. Marchoux, Salimbeni et Simond. Annales de l'Institute Pasteur, November, 1903.

duty upon the Yellow Fever Commission. "Dr. Carroll's interest in the subject has continued unabated, and he has embodied the knowledge acquired during his unique experiences in several papers of the greatest interest." (H. A. Kelly, loc. cit., p. 257.) Ever on the alert and keeping apace with yellow fever matters and any 'new work' performed by its numerous recent investigators, Dr. Carroll has continued the good reputation and maintained the dignity of the American Commission, whose results have been universally confirmed and practically unsupplemented.

Dr. Finlay's assertions (Medicine, Detroit, March, 1903) that the Commission had not given him proper credit for his theory and work, made it necessary for Dr. Carroll to publish "The Transmission of Yellow Fever," (*The Journal of the American Medical Association, May 23, 1903*), in which he set forth from Dr. Finlay's published writings the latter's claim and methods of experimentation and showed that the Commission had arrived at their conclusions by more accurate and scientific measures, but still acknowledged Finlay as the exponent for years of the mosquito theory, demonstrated by the Commission.

Carroll's best work since Reed's death, however, is evidenced in "The Etiology of Yellow Fever. An Addendum" (*Journal of the American Medical Association*, November 28, 1903). It is here that he conclusively controverts the claims of Working Party No. 1, Yellow Fever Institute, U. S. Public Health and Marine Hospital Service. In their elaborate report upon "The Etiology of Yellow Fever," a "protozoan parasite" named by them, "Myxococcidium Stegomyiae" found in the bodies of mosquitos infected by biting yellow fever patients, was described and pictured in its various stages and in different locations in the mosquito.

An editorial in the same number of the Journal in which Dr. Carroll's refutation of these claims appears, says:

"Not long ago the Yellow Fever Institute of the U. S. Public Health and Marine Hospital Service issued the report of Working Party No. 1, in which is described a protozoan parasite found regularly in certain mosquitos that had bitten yellow fever patients. This organism is described in detail and given the name 'Myxococcidium Stegomyiae.' On the face of it this report appears to be one of the most important contributions yet made to the much-vexed question of the etiology of yellow fever. The question was, Would it stand the test of scientific criticism?

"In this number of the *Journal* Dr James Carroll, of the U. S. Army, brings forward certain facts that tend to weaken one's confidence in the soundness of the conclusions of Working Party No. 1. Dr. Carroll shows that the fusiform stage of the *Myxococcidium Stegomyiae* cannot be connected with the transmission of yellow fever, and that the organism is a yeast fungus found quite commonly in mosquitos fed on over-ripe bananas purposely besmeared with yeast culture. Added to this we have the im-

portant fact that Dr. Carroll has not been able to find the organisms in mosquitos known to have produced yellow fever in human beings after they had bitten yellow fever patients early in the disease, the insects having been fed only on blood, dry sugar and water."

These results were duly and gracefully accepted by the officers of the Marine Hospital Service.

"Yellow Fever: A Popular Lecture," (*American Medicine*, June 3, 1905) delivered at Galveston, under the auspices of the University of Texas, is one of Dr. Carroll's recent papers. It posseses definite value as a means of popular education regarding the history, ravages and propagation of yellow fever, and how to exterminate the disease. Two thousand copies were, for this reason, issued by the University of Texas and in the New Orleans epidemic of 1905, 10,000 copies * were printed for distribution.

In "Lessons to be Learned from the Present Outbreak of Yellow Fever," (*Journal of the American Medical Association*, October 7, 1905), Dr. Carroll considers the last New Orleans epidemic; stressing the necessity for the recognition of those mild cases of the disease responsible for its introduction and continuance, he points to the necessity during the epidemic for a board of experts paid by the community to investigate every case of fever, for immediate report to the health department of the city when official means to prevent the further infection of mosquitos may be undertaken.

Reasons for believing that the specific organism of yellow fever is an animal parasite are systematically presented in "Without Mosquitos there can be no Yellow Fever," (*American Medicine*, March 17, 1906.) †

The value of the work of Major Reed, the ranking medical officer of the Commission, has been made so prominent since his death as to appear to eclipse the essential work of his colleagues, Lazear and Carroll, by whom was first actually demonstrated that the *Stegomyia Fasciata* is the source of yellow fever infection. The work of our Professor of Preventive Medicine, Gen. Sternberg, has been referrd to, and Prof. Welch cited upon its necessity as preliminary and fundamental to that of the Army Commission. No institution rejoices more in the achievements of one of its valued professors than does the George Washington University in the practical genius of Walter Reed. He was entitled to all he received, and it is hoped that his achievements will grow in renown and his personal qualities in the admiration and reverence of the world. But with the fame of Reed must also in justice be joined the equally important work

*Verbal statement of the President of a parochial medical society.

†Other papers by Dr. Carroll are listed in "The George Washington University Bibliography, September, 1904," with its annual supplements.

of Carroll and Lazear, for it was these three men of the Army Commission, who, standing upon the foundation of what had been done before, made the discovery.

Writing of Carroll, the only survivor, Dr. Kelly (Walter Reed and Yellow Fever, p. 256-7), says:

"All the reports of the Commission bear Dr. Carroll's name as well as that of Dr. Reed, and in reading them we should always bear in mind that, while the experiments were planned by the master mind of the chief, the accuracy with which they were carried out and the care by which all possible precautions were taken to exclude every source of error, are due to Dr. Carroll quite as much as to Dr. Reed."

In *Outlook*, August 11, 1906, pp. 834-35, appeared an editorial entitled, "The Republic's Forgetfulness," describing the work of the Reed-Carroll-Lazear-Agramonte Commission and its results, and asking, "What has the country done for the men who, at the hazard of their lives, have done so much for their country? Nothing."

I am informed that Dr. Lazear's widow receives a government pension of seventeen dollars per month.

In the Columbian University (now George Washington) after Major Reed's death, Dr. Carroll was made Professor of Bacteriology and Pathology; in the Army Medical School he was likewise given Reed's work as Professor of Bacteriology and Sanitary Microscopy; and made Curator of the Medical Museum; and in 1902 he was commissioned First Lieutenant. His promotion to the rank of Major in the Army Medical Corps has been talked of for several years:

"*Government Recognition for Brilliant Achievement.*—Some of the friends of Dr. James Carroll have from time to time suggested that his brilliant and courageous work in connection with yellow fever had won for him the right to some special recognition in official life and it has been suggested that the least that could be done for him would be to promote him to the grade of full surgeon, thus giving him rank and pay of a Major in the Army. We now understand that some of his friends are urging special legislation looking to such a step, and we believe *American Medicine* voices not only the feeling of Dr. Carroll's personal friends, but also of the entire medical profession of the country, when we say that this movement has our full endorsement and our best wishes for success. Dr. Carroll is now First Lieutenant and Assistant Surgeon. He has worked his way up from the ranks by hard, conscientious, faithful and courageous labor. We Americans have reason to be proud of him for his work, especially in connection with yellow fever." Editorial, *American Medicine*, November 26, 1904, pp. 906-907.

The following is taken from the Proceedings of the National Leglisla-

tive Council of the American Medical Association, published in the *Journal*, January 20, 1906:

"REPORT ON GOVERNMENT RECOGNITION OF THE SERVICES OF DR. JAMES CARROLL.

"Dr. John S. Fulton, of Maryland, introduced the following:

"WHEREAS, In the Year of our Lord nineteen hundred, a Yellow Fever Commission was appointed by the Army of the United States to investigate the causes of yellow fever and to devise means for its eradication, the said Yellow Fever Commission consisting of Dr. Walter Reed, surgeon in the Army of the United States, Dr. James Carroll, Dr. Jesse Lazear and Dr. Aristides Agramonte, acting assistant surgeons in the Army of the United States; and

"WHEREAS, The said Yellow Fever Commission, consisting of Dr. Walter Reed, Dr. James Carroll, and Dr. Aristides Agramonte (Dr. Jesse Lazear, deceased), did then and there determine the cause of yellow fever, and devise means for its prevention, by which means yellow fever was eradicated from Havana and Cuba, and thousands of lives have been saved in the United States and other parts of the Western Hemisphere; and

"WHEREAS, Dr. Jesse Lazear, an acting assistant surgeon in the Army of the United States, did subject himself to the bite of an infected mosquito, from which bite Dr. Jesse Lazear suffered death; and

"WHEREAS, Dr. James Carroll, an assistant surgeon in the Army of the United States, did subject himself to the bite of a mosquito infected with yellow fever, and suffered a grave and almost fatal attack of yellow fever, being the first attack ever experimentally produced: be it

"RESOLVED, That the National Legislative Council of the American Medical Association expresses its appreciation of the valuable work accomplished by the Yellow Fever Commission in the interest of humanity, the material and bodily welfare of the people and of the Army of the United States, and of the heroism and devotion of the aforesaid Major Walter Reed (deceased), Dr. James Carroll, Dr. Aristides Agramonte and Dr. Jesse Lazear (deceased); and be it further

"RESOLVED, That this Council commend to the Government of the United States adequate recognition of the gallant and meritorious services of the said Dr. James Carroll, the only surviving member in the Army of the United States of the said Yellow Fever Commission."

This report was unanimously adopted by a standing vote.

It may be prophetic when Dr. Kelly entitles him *Major* Carroll throughout his book. Last April (1906) Senator Dick introduced a bill (Senate 5888) authorizing the President to place James Carroll on the retired list with the rank of Major. The bill was referred to the Committee on Military Affairs of the Senate. Is the medical profession to let it end there?

The work of the Army Commission is highly esteemed abroad. The

following is taken from the President's Address,* 1906, British Medical Association:

"Major Ronald Ross's discovery that malaria is conveyed by mosquitos, which act as an intermediate host, has not only led to successful measures to practically eradicate malaria with its attendant evils, but has given the clue to the cause of yellow fever and its treatment, etc. The first positive proof that the Stegomyia was the carrier of the infecting agent of yellow fever was given when Carroll, in July, 1900, offered himself for a test experiment with a self-sacrifice worthy of all praise. He had a very narrow escape, but Lazear, of the American Commission, and Myers, of Liverpool, lost their lives. That the labors and sad deaths of these heroic men were not in vain is amply attested by the remarkable vigour and success with which the recent plague was stamped out, and the exemption secured by Havana and other pest centres."

The highest honor yet proposed for Dr. Carroll comes from the other side of the water in an editorial in the *British Medical Journal*, September 8, 1906. He is worthy of the honor proposed.

"In regard to yellow fever, Panama affords as striking an object lesson as Havana of the incalculable benefit to mankind that had followed the discovery of the cause of the disease and the manner of its transmission. The glory of the work which has had this striking consummation is shared by several men. The credit of the conception belongs to Dr. Carlos Finlay, who propounded the idea many years ago without attracting from the profession any attention but an occasional contemptuous notice. More fortunate than many true begetters of new truths, Dr. Finlay, at the meeting of the Pan-American Medical Congress, held at Havana in 1901, was acclaimed by the assembly as the author of the discovery which has already been so fruitful of good effects. Dr. Carter was another pioneer in the work which was brought to completion by the American Commission. Ultimately death snatched the reward from the hands of Walter Reed and Lazear, but Drs. Carroll and Agramonte still survive. It would, we think, be a fitting acknowledgement of the work of these four men if the Nobel prize were divided among them. It will scarcely be denied by any one conversant with the facts that their work is of far greater importance than that of several to whom the prize has been awarded in the past few years. The only original research work whose practical results can be held to compare with it is that which had brought malaria, that monster which till lately claimed so vast a tribute of human lives, within the control of man."

*British Medical Journal, Sept. 8, 1906.

THE EYE—FROM THE GENERAL MEDICAL POINT OF VIEW.*

By C. Norman Howard, M. D., Assistant-Physician, Out-Patient Department, University Hospital.

If the full effects of a particular disease could be traced, probably every tissue would reveal the sinister touch of its particular pathology. Intercommunication is reliable and swift, and following in its wake come the products of pathologic physiology, to depress the tissues and bear substantial testimony to an altered function and a suffering organ. The depression of remote tissues may be so brief and so slight that it has past before it can be assigned a place in the symptom group. In the other extreme, it may be so great that it overshadows at times the original lesion, as in the gastric crisis of locomotor ataxia, or the yellowish tinge to the skin following catarrh of the duodenum. There is a space between these two extremes which is not entirely filled with knowledge.

A disease may represent the center of a circle, and small arcs on the circumference all the tissues of the body. Thus we might tentatively place nephritis in the center and let each radius running from it terminate, and tell of the effect, upon the heart, the liver, the lungs, the eye and the lymphatics, etc., and if we could multiply the number until each organ or system had been drained of its crucial changes we would have a picture the study of which would preclude a mistake in diagnosis, because the picture would be the diagnosis. The name for it would be but a convenient title, even as pictures in the art galleries are known by their titles.

It is of interest to note that each one of the twelve main divisions of diseases (running the whole gamut from those due to animal parasites to those of the nervous system) has at one time or another been placed in the center of the circle and questioned as to its relation with eye pathology. This does not carry the implication that even the majority of the sub-divisions are held blamable, as far as our present knowledge is concerned, nor does it mean that I will recount more than will serve to illustrate my point of view.

In diseases of the blood and of the circulatory system, the eye is a potential field of information. In the examination of this fluid tissue and of this system we listen to it a little to the right of the

*Read January 20, 1906, before The George Washington University Medical Society.

left nipple line, and we feel it at the wrist and take away drops of it for observation and various tests. By instruments its power is noted and in old men we incidentally get partial shadows of it while taking some of the X-ray pictures. If there is then inserted a strong convex lens between the pupil and the ophthalmoscope there will be seen a bright yellowish-red background and resting upon it a terminal artery and the beginning of a vein; an integral portion of the system we are studying, actually at work in its own home. If there is a general change in the circulatory system, this terminal artery and this vein will not be slighted.

In arterio-sclerosis a retinal vein cannot be seen through the artery which crosses it, as formerly, because the latter has lost its translucency. There will also be found white stripes in the walls of the vessels where degeneration exists. In mitral disease (and in other conditions where there is a damming back of the blood from the head, as in emphysema or even in violent cough) the retinal veins are engorged and stand out big and thick compared with the retinal arteries, which have not undergone such radical change in size. Endarteritis may bring with it hemorrhagic retinitis, where the degenerating walls of the retinal vessels have given way. In this same disease of endarteritis there may be black specks floating across the yellowish-red reflex, and the patient sees them also and speculates as to cataract, whereas they are floating opacities in the vitreous. Then, again, a patient with arterio-sclerosis, or with aneurysm, or with valvular disease of the heart is suddenly deprived of his sight. A small fragment has broken loose from its moorings and traveled with the circulating blood until it has plugged an artery through which it could not pass. In this condition the ophthalmoscope may reveal an embolism in the retinal artery.

Under so-called diseases of the urinary organs, the inflammation of the retina occurring with nephritis is at once a valuable and an unfavorable sign. It is a sign which may, perhaps, be uncovered while making an unbiased ophthalmoscopic examination. The specialists tell us that two years after it is seen more than a slight majority of the patients are dead[1]. Here then is a finding of definite value in diagnosis and prognosis.

In diseases of the digestive system, constipation has been held responsible for some of the cases of recurring styes, and portal congestion for opacities in the vitreous.

It is of interest to note that in constitutional diseases as gout and rheumatism there is frequently associated a conjunctivitis, probably due to vaso-motor disturbance. In rheumatism we also have occasionally to contend with keratitis and optic neuritis. There is another

class of constitutional diseases, especially in children, in which there is said to be a "depressed nutrition" or a "strumous condition," or "the general health is not good." It would seem as though all the organs were being as evenly depressed as the constituent parts of Oliver Wendell Holmes celebrated "One-Hoss-Shay." Or it may be that no organ wishes to cry out for help, for fear that it may be held responsible for the entire trouble, while its equally culpable associates escape the odium of censure. Be that as it may, in these cases in children the cornea tends to become involved. It will be remembered that the cornea is a non-vascular structure and has to rely for its nourishment on the courtesy of neighboring vessels.

Under the group of intoxicants, we find the baneful effects of both wood and ethel alcohol, in the production of blindness through optic neuritis. A heavy user of tobacco will come to the physician complaining that he cannot see as well as formerly, and he is found suffering from dimness of vision without visible changes in the eye——amblyopia. Large doses of quinine have caused total blindness, from which gradual recovery may take place, but probably never to quite the normal limits.

In the specific infectious diseases we find keratitis frequently following measles and chroiditis has here to be also taken into the reckoning. Conjunctivitis often adds its mite to the symptom group of smallpox and scarlet fever. As a sequel to diphtheria, usually during the second or third week of convalescence, ten to fifteen per cent. of the patients have a local paralysis. This occurs oftener in the palate than elsewhere. Next to the palate, the most common site is paralysis of some of the muscles of the eye, due to toxic neuritis of the third nerve[2]. Tuberculosis manifests itself in various portions of the eye. The ravages of gonorrhoea in the eye through external infection are well known. Probably the metastatic infection of the iris through urethal gonorrhoea is not so well known[3]. It is apt to make itself manifest in those cases in which there is articular involvement due to gonorrhoea. The metastatic infection of the eye in obstetrics and surgery has also had the earnest attention of our friends, the ophthalmologists[4].

Of all diseases which we can place in the center of our circle the one which stands out most clearly as a causative agent of eye pathology is syphilis. Beginning at the eyelids and going back through the conjunctiva, the cornea, the iris, the ciliary body, the vitreous, the retina, the choroid and the optic nerve itself we find the ugly touch of this social plague. Through gumma of the brain the muscles of the eye may be rendered helpless by pressure on their paths of innervation embodied in the 3rd, 4th and 6th cranial nerves. Not that every syphilitic has all or even one of these eye conditions, because

no disease is uniform in its course. Were it so, medicine would rank with mathematics, and simple computations would take the place of masses of minutia in building up a diagnosis; nor on the other hand, are we debarred from using mathematics where we can. A patient may come to us complaining of uncertainty of vision, and he thinks it must be caused by his liver, because his eyes have acted queerly before when he was "bilious." Perhaps we concur in his diagnosis, or, perhaps, among our findings in the eye there will be a picture which resembles nothing so much as a dark red ball of clay, which being thrown against a yellowish-red wall has stuck until the center partially dropped away and left the rest of it sprawling there. Having found this peculiar distortion of the optic disk, we are minded to say he has optic neuritis and then we go forth groping for a cause and find that he had the initial sore of syphilis two years before.

At least three of the diseases of the nervous system have a diagnostic sign in the eye. Locomotor ataxia presents the Argyll-Robertson pupil, which contracts for near work, but not for light. The diagnosis of hereditary ataxia (Friedreich's Ataxia) is based on a group of symptoms of which one is the clonic rhythmical spasm of the external muscles of the eye known as "nystagmus." Multiple sclerosis is diagnosed by its volitional tremor, scanning speech and nystagmus. Hysteria, progressive paresis and tumors of the brain have each their eye manifestations.

And, lastly, if we enter the psychical arena we find the eye helping to express the mental state in happiness and in sorrow, in fear and in endurance. We find it steady with latent power in one patient of intellectual force, and shifting and weak in the incipient decay of another's will. And if a man is a general practitioner, studying the life problems of his patient, as well as his altered metabolism, these things too must add their quota to the diagnosis-picture.

In determining the relation between a given organ and the rest of the body, the foregoing alone would be incomplete. The remainder is obtained when the eye is taken from the circumference and placed in the center; when it ceases to be a partial index of other disorders and becomes the aggressor. Just what is this morbid influence through which the eye can affect the circumference? It is the pathologic physiology represented by errors of refraction and sometimes accompanied by muscle imbalance. It is eye strain.

It was my good fortune while serving on the staff of the Episcopal Eye, Ear and Throat Hospital, of this city, to examine 422 patients

with especial reference to their vision. Some of my findings I have noted in the following table:

Unaided vision in the right eye was better than the left in 22 per cent, or 94 patients, of which number 52 had vision of 20-20th or over;

Unaided vision in left eye was better than the right in 36 per cent, or 151 patients, of which number 77 had vision of 20-20th or over;

Unaided vision was the same in each eye in 42 per cent, or 177 patients, of which number 86 had vision of 20-20th or over.

Both eyes had the same type of error (excluding presbyopia) in 79 per cent, or 333 patients;

Each eye had a different type of error in 17 per cent, or 73 patients;

Presbyopia, without other refraction error, was found in 4 per cent, or 16 patients.

The following shows the relative number of the different errors of refraction in those whose eyes have the same type of error:

	Per cent.	No. of patients.
Emmetropia (without error)	3	10
Hyperopia	41	136
Hyperopic Astigmatism	16	53
Compound hyperopic astigmatism	22	74
Myopia	6	21
Myopic Astigmatism	5	17
Compound myopic astigmatism	4	14
Mixed astigmatism	3—	8
Total	100	333

Presbyopia, with other refraction errors, which are included in the above list, 56 patients, making the total number of presbyopics 72.

Vision was tested under homatropine in 72 per cent, or 303 patients; 86 per cent of this number were also examined with the retinoscope, being 263 patients.

These patients include old and young, black and white, and male and female and the data was obtained in the majority of instances in the following manner:

A patient coming to the dispensary for the first time and apparently having an error of refraction, the vision was ascertained and he was

told to report back early on the other afternoon in the week. At that time homatropine hydrobromate, grain one to the dram, was instilled in each eye. Starting an hour before my arrival, one drop was inserted at ten minute intervals until each eye had received six drops. He was then taken into the dark room and examined at one-half meter distance with a plane mirror retinoscope. This is an exact, objective, mathematical method of determining pathologic departures from the physiology of the eye. The pupil being dilated and the accommodation paralyzed it made any necessary ophthalmoscopic examination easy at this time. He was then tested with the cards and lenses. Although the effects of homatropine wear off in less than two days, it seemed best to not have them return on the other day that week, but to report back on the same day the following week. The accumulated data was then used in giving a final test and the glasses ordered. He was to secure the glasses the next day and wear them, and report back in two weeks with them. There were 159 patients out of the 422 in whom, it seemed to me, unnecessary to adopt the full method and it was curtailed in varying degrees with them. On the other hand, it was occasionally found that the homatropine had not sufficiently conquered a stubborn ciliary muscle and the patient was later given atropine.

My thanks are due Dr. Belt, the ranking officer on the staff, for the opportunity of serving these patients, and to him and the other members of the staff, Dr. Griffith and Dr. Lamb, for their aid in acquiring other clinical facts during my recent connection with the hospital.

In looking at the above figures it would seem that what might first attract attention is that 86 of these patients, or 20 per cent, had normal vision in each eye, and yet I found but ten who had both eyes normal. Then there were 129 other eyes distributed among patients whose vision was unequal which had normal vision; and yet I found but seven eyes divided among seven people which were normal. Now how were those eyes obtaining this normal vision? By working beyond their physiological capacity—by straining. And can we in safety say that this straining was only confined to them? Were not those in which the vision fell below normal not only making a greater effort against greater difficulties to accomplish normal vision and without the satisfaction of success? It has been interesting to note that, after the use of homatropine, patients have stated the eyes felt better; due to the rest received while lying in splints for two days.

Out of the great mass of material which has been written on eye strain, Dr. Gould apparently stands first as our most prolific and with his clear diction, most interesting of all those who have treated

of this subject. It must not be forgotten, however, that thirty-one years ago Dr. S. Weir Mitchell called attention to eye strain in its morbid effect upon the rest of the body, and he was probably the first one who did so[5].

Dr. Gould tells us that eye-strain is the greatest cause of inflammatory disease of the eye itself[6].

The most important radius, which we can follow to the circumference, when the eye is in the center, is that leading to the nervous system. It must be remembered that we have a constant drain on this system in helping the eye to cover its deficiencies, and further that the nervous system cannot show constant favoritism to one organ without its own and other systems suffering.

Thus we find eye-strain a causative agent in many cases of occasional headache, constant headache and in that peculiar, periodic and painful afflication known as "migraine," or "sick headache." This last trouble frequently comes to those of a highly nervous organization, especially if they are men and women of education and culture, who not only read and write a great deal, but demand of their eyes a clear transmission of what can be seen, even as they demand of themselves and receive from their associates a clear mental picture of a subject. If reference be made to the figures given above, it will be seen that in 17 per cent, or 73 patients, the type of error was not the same for each eye. One might, for instance, be far-sighted and the other astigmatic. Only in 7 of this number was one of the eyes normal. Imagine for a moment one eye attempting to overcome its error and passing its result, such as it may be, back to the brain, only to meet the result which another eye has acquired while struggling with a different type of error, and then the two are to form one picture. Is it any wonder that the owner is disgruntled and forces them to do their utmost at all times? It is perhaps fair to suppose that this constant insidious strain eventually produces a little irritation which grows and grows and finally culminates in a nervous storm so great and so far-reaching that the eyes and head and digestive system are all involved. Those who are interested in seeing how Dr. Gould believes that eye-strain can mar the happiness of men will find melancholy pleasure in reading his "Biographic Clinics, giving the origin of ill health of DeQuincy, Carlyle, Darwin, Huxley and Browning."

Toward the close of my series of cases I made definite notes regarding headaches. That is, at the time the glasses were ordered the patient was questioned as to whether he had had headaches, and, if so, for how long and how often. When he returned in two weeks or later, having secured and worn the glasses in the meantime, additional notes were made.

These notes resulted in the following:

Total number reporting back in regard to headaches, 50;

Headaches made worse after wearing glasses, 6 per cent, or 3 patients;

Headaches uninfluenced by glasses, 6 per cent, or 3 patients;

Headaches relieved partially or completely after wearing glasses, 88 per cent, or 44 patients.

This does not include those who had errors of refraction and suffered from headaches, but did not report back after wearing the glasses.

Epilepsy has long been considered as probably due to a constantly acting slight irritation. Gould found in examining 68 epileptics that 98 per cent of them had astigmatism[5]. Some epileptic patients have definitely ceased having convulsions after the correction of an error of refraction.

Insomnia, chorea and hysteria have all been held up as due in some cases to eye-strain and with apparent justification. In regard to the effect on the digestive system, the nausea and vomiting associated with migraine have been referred to. Anyone who doubts that nausea can be caused by the eye has but to place a cylindrical lens before a neurotic astigmatic patient and turn the axis the wrong way. Errors of refraction must also bear scrutiny in tracing the etiology of seasickness and car-sickness.

Having examined the eye from the general medical point of view it might be well, in closing, to remember that it is not the intention to exalt this organ to a high plane of diagnostic value or etiological importance above its fellows. It has only been dealt with here exclusively because that was the subject matter of the paper. It has a diagnostic value and it has an etiological importance, but it ranks in each above some and below other constituent parts of the body, and it was largely to determine its relative position that a study of it appealed to me as a general practitioner.

1. De Schweinitz—Diseases of the Eye.
2. Osler—Practice of Medicine.
3. Burnett—Journal A. M., Association, Dec. 23, 1905.
4. De Schweinitz—Univ. Penn., M. Bull, Phila., 1905-06, xviii, 78-81.
5. Gould—Biographic Clinics.
6. Gould—American Medicine, Oct. 10, 1903.

SYMPTOMATOLOGY AND TREATMENT OF EXOPHTHALMIC GOITRE AND REPORT OF CASES.*

By Dwight Gordon Smith, A.B., M. D., '03.

Exophthalmic Goitre since it was first brought to the notice of the medical profession almost a century ago, has been one of the most interesting and I may say one of the most mysterious diseases with which we are confronted. Always a fascinating study to the observer, of late it has become a source of an enormous amount of literature despite which, however, we still grope in the dark and the exact significance of the disease is yet unknown. On account of the latitude of the subject and the brevity of the time allowed me, I will devote myself entirely to the symptomatology and treatment of exophthalmic goitre, the two phases of the disease emphasized by the cases to be reported by me. These cases, eight in number, were treated in the service of Dr. James Dudley Morgan at the Emergency Hospital of this city, to whom I am indebted for his kindness in permitting me to make use of them. I also am indebted to Dr. W. E. Magruder, of Sandy Springs, Md., for data.

Exophthalmic goitre has five general symptoms which are now classic. They are nervousness, tremor, protrusion of the eyeballs, tachycardia and enlargment of the thryoid gland. These are always accompanied by secondary symptoms involving the various systems of the body. The thyroid gland is usually enlarged and in the majority of cases the enlargement is the first symptom noticed. The swelling may appear very slight until we remember that the normal gland can be rarely palpated and when a gland is of such size that it can be felt, we may be reasonably assured that it is diseased. The gland is seldom as large as it is in parenchymatons goitre. One lobe may be swollen more than its fellow and it is a curious fact that when such is the case the eye on the corresponding side protrudes more than the other. By reason of its increased vascularity the gland may pulsate but such was not the case with any of our patients.

The heart beats are accelarated and the face of the contractions increased. The pulse runs 90 to 150. Murray reports a case where it was 200. Cardiac murmurs may be present according to Gowers, Murray and Reynolds, but this was not found in any of my cases although one had a well marked hypertrophy of the left ventricle. Tachycardia occasionally is the first symptom to appear.

*Read April 26, before The George Washington University Medical Society.

Exophthalmos usually develops after the previous ones have made their appearance. The eyeballs may protrude to such a degree that the patient presents a ghastly and unnatural appearance or the protrusion may not be perceptible. Usually the eyes have a startled, staring look. In some cases the upper lid does not follow the eyeball when it is turned downward but descends with a jerky movement.—Graefe's sign. It was noticed in two of our cases. Stellwag's sign, a widening of the palpebral fissue owing to the spasm of the elevator of the lid was presented by two of the cases to be reported. Moebius's sign is a deficiency in the power of convergence of the eyes. It is demonstrated by causing the patient to look at a finger as it is moved toward the eyes. They converge until a certain distance is reached then they suddenly become parallel. This was seen in one of the cases. Conjunctivitis was present in two, one had marked pterygium.

All of the cases were troubled with severe attacks of mental anxiety and nervousness. Two were apprehensive of sudden death. All had violent palpitation when they were at all frightened. Four suffered from insomnia. Three had severe pains in the lumbar region and two in the limbs.

Tremor of the hands or feet or tongue is present in a majority of patients according to Murray and Gray. It is usually fine and according to Osler about eight to the second. It may be very pronounced interfering with writing or sewing but such severe cases are rare. Two cases had tremor of the hands and tongue and three of the hands alone.

One of the cases had elevation of temperature, the others were normal. One complained of hot flushings, one of feeling cold. Profuse perspiration by day or night is common. Loss of hair is frequent. Two had polyuria. According to Ord, Murray and Taylor this is a common symptom. Diarrhoea, which Osler, Murray, McKenzie and Ord say is very frequent occurred only once in my series, while three of the patients suffered from constipation. Amenorrhea is often present in female cases, two of my cases had it. Emaciation in various degrees was a feature in seven out of the eight cases. In two instances it was extreme. Osler says eighty per cent of exophthalmic goitre occurs among women, some writers claim ninety-five. Three of this series were men which is a very high percentage of males. None of the observers whom I have consulted mention race as a predisposing factor in the causation of exophthalmic goitre and none puts any stress on its prevalence among negroes. Six of this series were negroes.

Treatment: There has been prescribed a multitude of drugs for the

cure of exophthalmic goitre, and many therapeutic methods have been exploited. Nearly all have had their day and then been relegated to the past. Hygienic treatment is of importance as it is in other diseases, the conditions indicated being fresh air, good food, quietude, warm baths and a low altitude, the seaside being especially good. There is no need to send patients out of Washington as the climate here is favorable. Massage is beneficial in cases where the patients are confined to bed, but exercise is better when possible. Very severe cases should be treated by absolute rest in bed. Milk and a light easily digested diet should be ordered and rich food and stimulating beverages interdicted.

I will mention some of the drugs which have been employed in the treatment of this disease: Digitalis, strophanthus, opium belladonna, ergot, vetatrim-viride, iodine, iodides, bromides, salycilate of soda, phosphate of soda, thymus gland, and thyroid extract. One of the older methods of treatment still employed is that of inunctions of the ointment of red mecurial iodine. It is rubbed over the gland. The nervousness can be treated by the use of bromides. Anemia should be met with iron. For this purpose the elixir of iron, quinine and strychnine was given with success to several of my cases. Electrical treatment has its advocates, faradism being employed by Vigoroux, but others have not obtained the success that accompanied his treatment. Lockwood, Lewandoski and Charcot have employed galvanism. Hector McKenzie, Ord and Taylor do not advise it. Surgical interference has met with varying degrees of success. Some observers are enthusiastic, but others have not reported much success. The older operations were division of the isthmus, ligature of the thyroid arteries and denudation and exposure of the gland. The operations in vogue at present are Jonnesco's extirpation of the cervical ganglia and partial thyroidectomy.

The treatment employed on five of this series was the administration of sulphuric acid. About a year ago Dr. W. E. Magruder reported two cases of exophthalmic goitre treated by himself and three by his son, all of whom were cured by the use of sulphuric acid. Some years ago he had tried about every recommended agent in a very obstinate case of exophthalmaic goitre with no improvement. He then began the use of sulphuric acid with gratifying results. I will quote from Dr. Magruder's paper. He says: "While looking up the subject I was struck by the statement of Handfield Jones in his treatment of nervous diseases. 'Sulphuric and nitric acids certainly have some claim to be toners of the vaso-motor nerves, they cannot act in their original form on the parts which they influence as their quality must be lost the moment they enter the circulation.

They cannot be mere astringents like tannin. When sulphuric acid restrains choleraic purging or colliquative sweating, these effects must be surely produced by the nerves that regulate the arteries of the internal and external integument.' Something to give tone to the vaso motor system seemed to be indicated, so I determined to give sulphuric acid a trial." In addition to what Dr. Magruder says, Wood states that sulphuric acid is not merely a local astringent, but acts systemically.

Undoubtedly there is a vaso motor disturbance in exophthalmic goitre. Solis Cohen calls it a vaso-motor ataxia, Madison Taylor a cardio-vascular erethism. Such being the case theoretically the administration of sulphuric acid would seem to be a rational treatment of exophthalmic goitre. Dr. Morgan suggested that I try Dr. Magruder's treatment in the cases on our clinic. This suggestion was acted upon. Sulphuric acid was prescribed in six cases. One left the city, thus leaving five to be observed. Four are apparently well and one, who is still under treatment, has greatly improved and is practically cured. I will briefly report the five treated with sulphuric acid.

Case I. Louise C. admitted to the dispensary Dec. 28, 1904, colored, female, domestic, aged 34. For several months she had suffered from pains in chest, marked nervousness and insomnia. Exophthalmos was extreme, Graefe's sign was present. The pulse was 116, the thyroid gland enlarged. She also complained of leucorrhoea and constipation. She was advised in regard to hygiene and diet and was given sodium bromide and pills of aloin, belladonna and strychnine. She did not return until May, 1905, when her condition was much worse. The nervousness was increased and the gland larger. Aromatic sulphuric acid (twenty drops thrice daily) was prescribed. By the latter part of June she had greatly improved, the pulse being 96 and the nervousness ameliorated to a marked extent. The treatment was continued faithfully and on September 25, 1905, she was apparently well. She slept well, had no pain, the exophthalmos had subsided, the gland was reduced in size, pulse normal, the nervousness had disappeared and the patient had gained in weight. Since then she has had no return of her old symptoms.

Case II. Betty M, colored, female, domestic, aged 24, came to hospital July 25, 1905. She was extremely nervous and in great mental anxiety. She had tremor of the hands and tongue, swollen thyroid gland, marked exopthalmos, tachycardia (pulse 128), anemia and emaciation. She was given elixir of iron, quinine and strychnine and aromatic sulphuric acid (drops, twenty) three times daily. In one month she improved greatly, all symptoms decreasing. By

September 15 the exopthalmos had decreased and the thyroid gland had diminished in size and the patient was cheerful and contented. On November 29 the pulse was 79, the nervousness gone, the gland and the exopthalmos greatly reduced and the tremor had disappeared. She did not come back to the hospital until January 23, 1906, but there was no return of her previous condition. She was told to report from time to time.

Case III. William M. colored, male, laborer, aged 21, came to dispensary March 10, 1905. He had suffered from severe attacks of nervousness and mental anxiety for several months and had been troubled with malaise, anorexia and profuse night sweats. As he was rapidly losing weight he was tortured by the fear that he had tuberculosis. He had exophthalmos, tachycardia, enlarged thyroid and polyuria. He was given sodium bromide, returned to the hospital once and after that not until May 10, 1905. He was in a pitiable condition. The mental anxiety was extreme, simulating melancholia, the pulse 120, and the gland much larger. He was given aromatic sulphuric acid and immediately began to improve. On May 23, all symptoms were lessened, the pulse 101. This improvement kept up, each visit to the hospital showed a gain in his condition. By August his pulse was 81, the nervousness pains and polyuria had all disappeared, the exophthalmos reduced nearly to normal and the gland scarcely palpable. He has had no return of the symptoms since then.

Case IV. William B, colored, male, aged 20, entered dispensary March 20, 1906, complaining of pains in the chest and lumbar region, loss of weight and night sweats. He was in mental agony, fearing that he had tuberculosis. He also suffered from malaise, anorexia and shortness of breath, eyeballs protruded extremely. Stelwags and Moebius's signs were present and on the left eye was a pterygium. The thyroid gland was swollen and tremor of the hands was marked, the pulse 140, the apex of the heart was displaced downward and to the left, anemia was marked. He was given the elixir of iron quinine and strychnine and aromatic sulphuric acid, twenty drops three times a day, which was later increased to half a teaspoonfull. Ten days later his pulse was 72 and the nervousness and tremor had disappeared. He is still under treatment. He has gained in weight, appetite is good, night sweats have disappeared and the pulse is normal. Already the gland is smaller and the exopthalmos decreased.

Case V. Carrie S., colored, female, domestic, aged 36. Patient was always of a nervous temperatment, showing a marked neurotic taint. She came to the hospital December 7, 1904. For a year she had

periods of feeling cold, which alternated with attacks of profuse perspiration. She had suffered from severe pains in limbs and chest and loss of weight. The exophthalmos was the most extreme of the series, the patient having a startled, staring appearance. The thryoid gland was quite enlarged, the tachycardia pronounced, pulse running up to 150 at the slightest provocation. The patient was emaciated and anemic. The peripheral veins were congested. The menstrual function had been suspended for a year. She was instructed in regard to hygiene and diet and thyroid extract was prescribed, also tincture of strophanthus. By December 29 she had improved very little and iron was ordered. For three months she came to the dispensary once a week with little or no apparent benefit. On April 28 she was given sulphuric acid. May 6 she was better, the pulse was 82 and the nervousness greatly relieved, the gland and the exophthalmos unchanged. During the summer she continued to improve in every way. By October the gland had become greatly reduced in size, the exophthalmos hardly discernible, and the nervousness, tachycardia, sweating, amenorrhea and pains were things of the past. She had increased in weight, and, as she expressed it, she felt like a new woman.

In conclusion, I will say that it is too early to state that sulphuric acid is a specific for exophthalmic goitre, but in view of the two cases cured by Dr. Magruder and three by his son and the five cases so greatly improved, and probably cured, in our clinic and no failures in the ten trials, sulphuric acid should have the benefit of a thorough test on every case of exophthalmic goitre.

ANNUAL ADDRESS OF THE PRESIDENT OF THE GEORGE WASHINGTON UNIVERSITY MEDICAL SOCIETY.*

By A. Barnes Hooe, M.D., '96.
(Gynecologist, Out-Patient Department, University Hospital.)

Gentlemen: During the summer of 1905, several Alumni of the Medical Department of The George Washington University deemed it advisable to form a medical society in this city whose membership should be composed of Alumni of this Department. On September 23d, a call, signed by ten Alumni, was sent out to all of the body who were resident in Washington and vicinity to meet in the medical building of The George Washington University on October 7th to consider the advisability of such an organization. About fifty responded, and decided to form such a society; and a committee was appointed to prepare a constitution and by-laws and to submit them for consideration at a subsequent meeting. On October 27th, at a meeting held at Rauscher's, a permanent organization was effected, a constitution was adopted and officers were elected. About eighty were present at this meeting, including Dr. Needham, President of the University, and many of the medical faculty in addition to the Alumni.

In the selection of officers, the Society saw fit to bestow upon me its highest honor by electing me its first President, an honor which I sincerely appreciate. We have passed one year of successful activity with ever-increasing enthusiasm and interest and our members have presented at our monthly meetings many valuable scientific papers. Now at our closing meeting it becomes my duty to make the annual address as President prescribed in the constitution, and I trust you will bear with me while I sketch the history of the Medical Department of The George Washington University; with the limited time at my command, my address must necessarily be brief.

In the early days of our Colonists the care of the sick was mostly in the hands of the clergy, who deemed it their duty to look after the physical, as well as the spiritual welfare of their parishioners. While early American history informs us that there were at times physicians among the Colonists, as in the case of the physician who accompanied Captain John Smith in his expedition up the Potomac River, yet we are led to believe that they were not always at command, for later, when Captain Smith was injured by an explosion of gun-powder, he had to return to England for surgical care. Our early American medical history is very interesting and some of its accounts curious. The first American publication in this field was a book-

*Presented at the first annual meeting of the Society, held at Rauscher's, May 19, 1906.

let entitled, "A Brief Guide in the Smallpox and Measles," written and published in 1677 by a clergyman, and the second, which followed about two years later, entitled "A Good Management of the Distemper of the Measles," was also by a minister of the gospel.

We learn that early in the eighteenth century there were a few regular physicians, educated in Great Britain, scattered about among the Colonists, but not until about 1750 was any effort made to give our young men careful instruction in medicine. The little they could learn from the few physicians in the country was by talking with them and using their very limited libraries.

The first serious attempt at teaching medicine was in 1756, when Dr. William Hunter, a celebrated Scotch physician, delivered a course of lectures in Newport, Rhode Island, to which all medical students, physicians and cultured men of the city were invited. In 1765, two young Americans who had been educated in Edinburg, started the first medical school in America in the city of Philadelphia, which was first connected with the College of Philadelphia, and became ultimately a department of the University of Pennsylvania. This school being a success, New York organized a school two years later known as the Medical Department of King's College. Fifteen years later the Medical School of Harvard was organized, and was the third in America. Although Harvard College was organized in 1636, not until 1782 was a medical school attached to it. The fourth medical school to be founded was that of Dartmouth, which was organized in 1797; for the first twelve years it had only one professor, who taught all the branches of medicine and graduated a number of physicians. Then followed:

5th. The College of Medicine of Maryland in 1807.

6th. The College of Physicians and Surgeons of the Western District of the State of New York in 1812.

7th. The Medical Department of Yale in 1813.

8th. The Medical College of Ohio in 1818.

9th. The Vermont Academy of Medicine in 1818.

10th. The Medical School of the Transylvania University in 1818.

11th. The Medical School of Maine in 1820.

12th. The Medical Department of Brown University in 1821.

13th. The Medical Department of the University of Vermont.

14th. The Berkshire Medical College at Pittsfield, Mass.

15th. The Medical College of South Carolina.

16th. The Medical School of Jefferson College, Philadelphia.

17th. The Medical Department of the Columbian College, now the Medical Department of The George Washington University, which was chartered the 9th day of February, 1821, but did not begin a regular course of lectures until 1825.

About 1817, Rev. Luther Rice conceived the idea of establishing a College in the District of Columbia and in 1819, a tract of land embracing about forty-seven acres, situated between Fourteenth and Fifteenth Streets N. W., and north of Boundary Street, (now Florida Avenue) was purchased for about $7,000. A building was erected at a cost of about $35,000, which was sufficiently completed to allow the opening of college in 1822. Congress had granted a charter to Columbian College which was signed by President Monroe on February 9, 1821. This charter empowered the trustees and faculty to establish academic and professional schools and to confer degrees. The following schools were at once projected: Preparatory, Collegiate, Theological, Law and Medical. The records show that the first classes were gathered together in 1822 and the first graduates received their diplomas in 1825, but the official Alumni list shows the names of Alexander Ewell, of Virginia; Albert Fairfax, of Virginia, and James D. Knowles, of Rhode Island, as Alumni of the class of 1824.

It appears from the records that the Medical Department was not fully organized until 1825, but it is more than probable that medicine was taught from the beginning, as we find among the first professors, Dr. Thomas Sewell, Professor of Anatomy and Physiology and Dr. James M. Stoughton, Professor of Chemistry, Geology and Surgery, both of whom were elected in 1821; Dr. Thomas Henderson, Professor of Theory and Practice of Medicine in 1824; Dr. Nicholas Worthington, Professor of Materia Medica in 1824; Dr. Alexander McWilliams, Professor of Botany in 1824, (elected to the vacancy caused by the death of Dr. Craven.) It is altogether probable that these gentlemen were giving instruction in their respective branches before 1825.

A digression is permissible here to pay tribute to Professor Thomas Sewell and also to the Trustees for their wisdom in selecting him as the Senior Professor in the Medical Department. He became the bone and sinew of the school and from his published works alone we can gather the history of the Medical School prior to 1839. The Medical School became a complete department in 1825; Professor Thomas Sewell delivered the opening address on March 30th of that year, a copy of which is preserved in the United States Army Medical Library and also in the library of the Department of Medicine.

Just when this address was delivered, or where the original medical building was located, is unknown, but it is probable that it was on the College grounds. There is an old record to the effect that the first building occupied by the Medical School was erected by the Professors themselves, but the location is not given.

The first class to receive the degree of Doctor of Medicine was in 1826, there being seven graduates; and from this time up to and includ-

ing 1834, classes were graduated yearly. From 1834 until 1839 there is no record of a continuance of the Medical School, but in June 1839, at the request of Professor Sewell, there was a meeting of physicians at his office, the object of the meeting being to consider the practicability of attempting to reorganize the Medical Department of Columbian College. There were present upon that occasion, Drs. Thomas Sewell, Thos. P. Jones, Harvey Lindsly, Thomas Miller, J. M. Thomas, J. F. May, J. C. Hall, and Frederick May. It was decided to reorganize, and the following gentlemen were elected to fill the chairs: Professor Sewell, Pathology and Practise of Medicine; Professor Thomas P. Jones, Chemistry; Professor Lindsly, Obstetrics and Diseases of Women and Children; Professor Thomas Miller, Chirurgery and Practise of Surgery; Professor J. W. Thomas, Materia Medica; Professor J. F. May, Anatomy and Physiology.

Dr. Sewell was elected President of the Faculty and Dr. May, Secretary. The Faculty decided to hold the lectures in a central section of the city and a committee was appointed to procure a satisfactory building. They at first decided upon the Purdy Building on Four-and-a-half street and Louisiana Avenue N. W., and signed a five-year lease for it, but before taking possession, it was deemed wiser to lease a building at the corner of Tenth and E streets northwest, from General Van Ness. Upon the payment of $100, Mr. Purdy released them from the contract for his building. The money for the rental of the Van Ness Building, ($600 per annum), was to be raised among the faculty.

The first catalogue was issued in August of that year, and spoke particularly of the facilities for work in Anatomy, Chemistry, Practise of Medicine and Surgery and also stated that the students would be required to perform operations upon the cadaver. The course began the first of March, and two courses of lectures were necessary to become eligible for the Degree of Doctor of Medicine. At this time, private articles of agreement of curious interest were entered into by the Faculty, as follows:

"First. To exercise toward each other at all times a spirit of courtesy, kindness and forbearance.

Second. To endeavor to secure for each other as far as possible, the confidence and respect of the Medical Class.

Third. To impart to each other any suggestions and to give any advice which may be useful to the school or to themselves as individuals.

Fourth. To see that the opinions and doctrine of each Professor in his proper branch are not to be controverted or animadverted by any other Professor, and a spirit of deference and respect is to be cherished towards each Professor in all things which appertain to his particular branch, in which he is regarded as authority.

Fifth. In case of the existence of any prejudice or misunderstanding between two or more members of the Faculty, it shall be our duty to bring about a satisfactory explanation and reconciliation. In the event of a failure to accomplish this, the case shall be referred to the Board of Trustees, whose decision shall be final and satisfactory to all the parties."

"The spirit of the foregoing agreement we consider as extending to our professional and private interest and character as well as our character and interest as Professors."

At a later date the following articles were added to the above:

"WHEREAS, the harmony and personal confidence of members of this Faculty are considered indispensable to the permanence and prosperity of the Institution, it is therefore resolved that we cannot be too strict in the observance of these rules of propriety and etiquette, which should govern its Professors."

"*Resolved*, That every physician has a right to regard the individuals and families who have solicited him as their medical attendant as he would regard his own family, free from all interference of his professional brethren, and that it is unworthy of the purity and dignity of the physician, and especially of the Professor of the Medical College, where it becomes his duty to inculcate both precept and example of a correct system of medical ethics, to endeavor, directly or indirectly by himself or by the hands of another, to insinuate himself into the favor of any individual or family with a view of becoming their physician when such families or individuals have already selected their medical attendant."

The Faculty was evidently composed of very unselfish men, who were working to promote medical education because they thought it their duty and certainly not because of the pecuniary compensation, as is proved from the record of March 17, 1843. This record shows that at the close of the Dean's books for that year, there was but one hundred and twenty-six dollars and forty-five cents on hand, which was evenly divided among the six members of the Faculty. This is the first reference to their having received any compensation at all, while there are many recorded statements of assessments of the Faculty to raise the necessary amounts for the current expenses of the school.

On the 6th of November, 1843, a Medical Dispensary was opened in the medical building where clinics were given daily, except Sunday. On June 15, 1844, the following bill passed the United States Congress:

"And it is further enacted, That the Commissioner of Public Buildings be directed to allow the Medical Faculty of the Colum-

bian College, District of Columbia, to occupy the Insane Hospital, with the adjoining ground situated in the Judiciary Square .n Washington, for the purpose of an Infirmary for medical instruction and for scientific purposes, on condition that they shall give satisfactory security to keep said building in repair and return it, with the grounds, to the Government, in as good condition as they are now in, whenever required to do so."

The Faculty took possession of this hospital July 1st of that year and called it the City Hospital. The school continued here until 1861, when the Faculty were required to return the building to the Government, and it was occupied as the United States Army Hospital until November 3, 1861, when the whole structure was destroyed by fire.

In April, 1845, the Medical School sustained a great loss in the death of Professor Thomas Sewell. On March 1, 1847, with the consent of the trustees, the name of the Medical Department was changed to that of the National Medical College. In 1861, there were graduated twenty-four students, among whom we find the name of one who is endeared to every graduate from this school in the past third of a century, and whom we sincerely trust an all-wise Providence will continue with us for many years to come. I refer to Professor A. F. A. King, for so many years Dean of the Department.

In the fall of 1861, having vacated the Government building, the School was removed to a building on E Street between Eleventh and Twelfth Streets N. W., known as the Constitution Office. On April 1, 1862, steps were taken to secure the building situated where our present medical building is now located. The Civil War being at this time in progress, several of the Faculty had responded to the call of their country and the number of the students was very small. As the result, it was deemed advisable to suspend during the course of the Session of 1863-'64.

On July 29, 1865, the Faculty reassembled when they were informed by the President of the University that Mr. W. W. Corcoran had presented the building located at 1325 H Street N. W., to the Medical School. But the War Department had possession of the building and refused to vacate it immediately. Lectures were therefore begun in the law building. On January 31, 1861, Dr. J. Ford Thompson was elected to fill the chair of Anatomy and Physiology. In July, 1866, Dr. A. F. A. King became adjunct to the Chair of Materia-Medica and the late Dr. D. W. Prentiss (father of our present Secretary), whom most of us remember so pleasantly, became adjunct to the Chair of Chemistry. At a meeting of the Trustees of the University on October 25, 1866 it was decided that all the members of the Faculty should be elected annually, to which the Medical Faculty demurred, and on October 27th, the Medical Faculty resigned in a body, but upon the request of the President, they agreed to withdraw their resignations.

On November 21, 1866, the building presented by Mr. Corcoran was formally accepted and the introductory lectures given therein. On July 10, 1872, the Chair of Surgery was committed to one who has so ably filled it up to the present time, Professor J. Ford Thompson.

It was necessary from time to time to make changes in the building to accommodate the increase in the number of students, but no great change was made until 1887, when the building was very much enlarged and the laboratory facilities greatly improved. Since leaving the City Hospital in 1861, the School had depended for clinical facilities upon the use of wards of the different hospitals throughout the city. For years efforts had been made to erect a hospital under the control of the Medical School, but not until 1898 were they successful, when a small hospital was opened where our new hospital now stands. As the school had grown so rapidly and the members of the Faculty were anxious to keep abreast of the times they deemed it advisable, under the leadership of our late Dean de Schweinitz, to have a more modern and larger Medical Building and Hospital, and therefore, the old building of both the Medical School and Hospital were replaced in 1902 by the commodious modern buildings now occupied by the Medical School and The George Washington University Hospital.

The Hospital, as you all know, is a modern and up-to-date building capable of accommodating one hundred patients. In the wards of this hospital our graduates of today receive their daily clinical instructions in all the branches of medicine and surgery.

On September 1, 1904, the name of the University was changed from the Columbian University to The George Washington University, a name which in itself makes it, so to speak, a national university and one which if properly fostered, as we all believe it will be, is destined to become one of the great universities of these United States. As the result of the wise policies of President Needham and the able leadership of Dean Phillips, our department is steadily advancing toward the realization of its high ideals and with enthusiasm and hope we face the future. The medical Alumni, we believe, are thoroughly loyal to their Alma Mater, and it is our duty to co-operate with each other in every way possible that banded together for large achievements, we may add to the prestige of our institution as a whole and contribute in no small measure to the success of the Medical Department of The George Washington University. If it succeeds, as it certainly will, we have done no more than our duty; if it should fail, then Fellow-Alumni, we are to blame.

SCIENTIFIC NOTES.

Dr. J. Ford Thompson, Professor of Surgery, has been granted a year's leave of absence and has presented his resignation, to take effect at the close of the session of 1906-'07. His colleague, Dr. A. F. A. King, formerly Dean of the Department of Medicine, characterizes the services of Dr. Thompson to the University as follows:

"It has become a common custom in this world to laud those who die. But why not extend our meed of praise also to the living? Certainly no man more fully deserves such commendation than our distinguished Professor of Surgery, Dr. J. Ford Thompson, who, after forty years of service, first as Professor of Anatomy and later as Professor of Surgery, has recently tendered his resignation of the latter chair. Succeeding the late Dr. Thomas Miller, Dr. Thompson began to lecture on anatomy in the University in 1865. A few years later (1872) he became Professor of Surgery and has continued to perform the duties of that chair until the session of 1905-'06, when he delivered his last course of lectures to the Medical Class."

"As a teacher of surgery, Dr. Thompson's method of instruction was pre-eminently practical. A fearless and skillful operator in all departments of surgical work, he was able to demonstrate the principles and methods taught in the lecture room by clinical examples in the several hospitals where, for so many years, he performed the duties of an attending surgeon. Always punctual and conscientious in the onerous duties of his university and hospital appointments, with a more than humane indifference to pecuniary reward, Dr. Thompson, in his retirement from the Medical Faculty, carries with him the unlimited esteem and affection of hundreds of students who have profited by and enjoyed his instruction, and also the warmest personal regard and best wishes of his colleagues in the Medical Faculty."

In connection with the paper appearing in this number on "Yellow Fever Investigations," it is interesting to note that as early as February, 1883, Dr. A. F. A. King, Professor of Obstetrics and Dean Emeritus, read before the Philosophical Society of Washington, a paper entitled "Insects and Disease, Mosquitoes and Malaria." (*Popular Science Monthly*, xxiii No. 5, Sept. 1, 1883). In his paper Dr. King presented a "series of facts—some of the best known and most generally established facts—with regard to the 'malarial poison' and showed how they may be explicable by the supposition that the mosquito is the real source of disease, rather than the inhalation or cutaneous absorption of marsh-vapor." Dr. King mentions Dr. Josiah Nott, of Mobile, Ala., who published in 1848 an essay

on yellow fever, in which the mosquito is referred to as the probable cause of malaria and yellow fever,(*New Orleans Medical and Surgical Journal*, iv, 563-601, 1848).

Dr. Nuttall in a paper discussing the mosquito-malarial theory ("On the role of insects, arachnids and myriapods as carriers in the spread of bacterial and parasitic diseases of man and animal. A critical and historicl study." By Geo. H. F. Nuttall, M.D., Ph.D., Johns Hopkins Reports, Vol. VIII, 1899.) says:

"In 1883 a most elaborately stated argument was published by King, in which he brings together a mass of evidence on the subject, vastly more, in fact, than other authors have since gathered, and I shall often have occasion to refer to his paper. It is curious to look over the more recent literature on the subject to see how writers have rediscovered the mosquito-malaria theory. In France the theory is ascribed to Laveran, in Germany to Koch and Pfeiffer, in England to Manson, whilst in Italy the names of Bignami, Mendini and lastly, Grassi are identified with it. By far the most masterly theory was written by King." All of these other scientists made their announcements of this theory between 1891 and 1898. Dr. King did not claim to have proven his theory but hoped that others might be stimulated to establish it by experiment. In closing he presents means of prophylaxis against malaria by protection against mosquitoes and their destruction—means which hold today.

Dr. George N. Acker, Professor of Pediatrics and of Clinical Medicine, has a suggestive paper in THE AMERICAN JOURNAL OF OBSTETRICS, October, 1905, on "The Diagnosis and Treatment of Pneumonia in Children." He believes that a patient with pneumonia, as those suffering from other diseases of the lungs, should have a large amount of fresh air. Many (this includes some physicians) appear to consider it a sin to allow any fresh air in the sick-room, but think that the little one must be kept in a hot, close room with woolen goods or cotton jacket about the chest. In a case in which the author was a consultant last winter, the infant was in a room 15 by 17 feet. There were four persons present, and a large gas stove helped to heat the room. The temperature was about 80 degrees F. and the windows were closed. The little patient was enveloped in heavy clothing. There was marked respiratory dyspnea and cyanosis. The child was dying for want of fresh air. The physician in charge was a capable man, and he explained to the author that it was impossible to get the parents to observe the proper hygienic measures.

The diet is of the greatest importance, for the digestive organs must be kept in good condition. If the temperature of the child is high, sponging with cool or tepid water will allay the nervous symptoms and promote rest. Small doses of the sweet spirit of nitre or solution of acetate of ammonia (if neutral) will have a good effect on the fever, but the

coal-tar preparation must not be used for this purpose. Expectorant medicines are not of any, or are of little, value in the disease, and often impair the digestion. The carbonate of ammonium and aromatic spirits of ammonia are at times useful as respiratory stimulants. Alcohol and strychnine will be necessary in many cases when the vital forces are on the wane. If the cough is harsh and dry, the air should be kept in a moist state, and the croup kettle (with compound tincture of benzoin in the water) is admirable for this purpose. Unless the cough is very troublesome it does not require treatment, and certainly one must be cautious in the use of opium, for if given to relieve cough it interferes with the secretions and embarasses the respiration. It is necessary for the patient to cough to remove the mucus from the bronchial tubes. A teaspoonful of hot water will often have the effect of quieting the cough. A mild mustard plaster is often of service. The chest can be rubbed with camphorated oil or Roche's embrocation, this latter being a favorite application with the author. It is a fad at the present time to apply clay preparations to all the ailments of the body; but as the author has observed blisters produced by the application of one of these on several infants he warns against their use—he has never noted any good from them in cases of pneumonia.

The heart's action and the skin must be watched, and if the former shows any signs of fatigue or the latter any cyanosis, increased stimulation must be resorted to and warm mustard baths and dry cups may be employed.

Beverly Robinson, who has paid considerable attention to the prevention of pneumonia, has observed that the micrococcus lanceolatus is one of the least tenacious of life among the pathogenic microörganisms, and that it does not thrive in an acid medium; therefore, he recommends the frequent use of acid mouth washes in times when the disease is prevailing. The sputum, stools, and urine of the patient should be destroyed, and the mouth washed frequently with an antiseptic solution. The antipneumococcic sera have not been found to have any marked benefit, though some have thought that there has been a slight reduction in the mortality shown. Even those who have given the serum in large doses have not been able to report any great success. One of the prime factors in the treatment of pneumonia is to watch the condition of the stomach and bowels, for in nearly every case there is great disturbance of these organs. The food must be such as will easily digest and cause no fermentation. If the stomach and bowels keep in good condition, the battle is half won. Milk should be diluted and not given in too large quantity at a time. The child should be fed at regular intervals, and plenty of good water given. The bowels should be opened at the commencement of the disease with castor oil or calomel, and afterward kept open by enemata.

Dr. D. Kerfoot Shute, Professor of Anatomy and of Clinical Ophthalmology, has just published in the New York Medical Journal for August 18 and 25, an article entitled, "A Model for a New Ophthalmotrope; the Gonioscope. Some Phases of Ocular Motility." In this article he describes a model for a new ophthalmotrope, which he constructed and exhibited before the Society of Ophthalmologists and Otologists of Washington, D. C., and also before the Medical Society of the District of Columbia.

Unlike all other existing ophthalmotropes, Dr. Shute's model is based upon the principle of diversity instead of community of the axes of rotation for the superior and inferior recti muscles and for the oblique muscles. His ophthalmotrope is for the purpose not only of studying the physiological movements of the eyes, but also for investigating pathological rotations of the eyes. All current text books upon physiology and ophthalmology adopt the theory of community instead of diversity of axes of rotation, and thus bring the teachings of physiology and ophthalmology into inexplicable conflict with the whole clinical experience of the past in diseases of ocular motility. Dr. Shute's model demonstrates with precision and ease the accuracy of this vast clinical experience accumulated by the masters in ophthalmology during the last three or four decades. His studies in ocular motility led him to devise a simple apparatus for which he coined the name gonioscope (*gonia* angle; *skopein* to view). This instrument is for the purpose of noting the varying angles made by the optic axis (in different positions of adduction and abduction of the eyes) with the lines of force (muscle lines) of the two oblique muscles and of the superior and inferior recti muscles, and for aiding, therefore, in understanding the theoretical effects of contraction of a single one of the above-mentioned muscles; all of which is a necessary preliminary to a correct appreciation of the symptoms of a single ocular muscle when paralyzed.

Dr. Shute states in his article that the ophthalmotrope and gonioscope devised by him were the outcome of his own difficulties in the study of ocular motility—one of the most complicated and involved subjects in the whole range of ophthalmology. Because the facts of physiological as well as pathological ocular motility are so difficult for the average student, and even for many ophthalmologists to understand, Dr. Shute has also published in his article several (four) original diagrams, illustrating ocular rotations. For details upon the subject, the reader is referred to the article in the New York Medical Journal.

Dr. Sterling Ruffin, Professor of The Theory and Practice of Medicine and of Clinical Medicine, in the April, 1906 number of the *American Journal of the Medical Sciences*, reports at length on "Hodgkin's Disease.

Study of a Case with Relapsing Fever," accompanied by the clinical chart. Before entering upon the description of his own case, Dr. Ruffin reviews the history of Hodgkin's disease and discusses its pathology recently found by Dorothy Reed, by Longcope and others, to be distinctive; also the symptoms, diagnosis, and course of the disease. The patient, a man, twenty-four years of age, was admitted in the fall to the open wards of the University Hospital where he was carefully studied by physical and laboratory methods. The most remarkable feature he presented was the temperature curve which showed during the four months and a half he was in the hospital periodic pyrexias alternating with remissions of fever. A mild infection with uncinaria Americana was found. The necropsy with study of the tissues and organs, revealed the distinctive pathology mentioned and confirmed the work of Reed and of Longcope. Two photomicrographs of lymphnodes illustrate the paper.

Dr. Charles W. Richardson, Professor of Laryngology and Otology, is preparing for the Fraenkel number of THE LARYNGOSCOPE in conjunction with other teachers, an article entitled, "The Teaching of Laryngology in the Medical Department of The George Washington University." Dr. Fraenkel has charge of the throat and nose department of the University of Berlin and is one of the most distinguished teachers in this line in the world. THE LARYNGOSCOPE, the leading scientific journal in its field in this country, is publishing what is called the Fraenkel number, in commemoration of the fiftieth anniversary of Dr. Fraenkel's life as a teacher. This number is to appear the first of November. In the September number of THE LARYNGOSCOPE Dr. Richardson had a paper on "Further Research in Perforation of the Septum Naris." The international clinic will soon publish an article by him on "Mastoid's Operation," with illustrations."

Practise of Gynecology. In Original Contributions, by American Authors. Edited by J. Wesley Bovée, M.D., Professor of Gynecology, George Washington University, Washington, D. C. Illustrated with 382 engravings and 60 full-page plates. Cloth. Pp. 836. Price $6.00 net. Philadelphia; Lea Brothers & Co., 1906.

The above volume, edited by J. Wesley Bovee, M.D., Professor of Gynecology in this University, with contributions from him and six other American physicians, has met with a most favorable reception from the medical profession. Dr. W. Easterly Ashton, of Philadelphia, in a private letter, speaks of it as follows:

"I want to congratulate you upon the character of the book, as it thoroughly represents the most advanced work in gynecology and at the same time it possesses the very important feature of positive teaching, so frequently absent in surigcal works."

The AMERICAN JOURNAL OF SURGERY says:

"This volume forms the first of a series of three, which respectively will cover the subject of gynecology, obstetrics and pediatrics. Unlike most collaborations, it shows neither repetitions nor omissions, and the exposition throughout is uniform and smooth. The aim of the book is eminently practical, but quite sufficient regard has been accorded to theory, pathology and bacteriology. * * * * * * * * * * * * * * The seven contributors have succeeded in presenting a volume of sterling worth, well balanced, concise and instructive. The illustrations, with very few exceptions, are of the first order, and in most instances are original. The plates showing the successive steps of important operations elucidate the technic more plainly and more instructively than can many pages of text. The typography and the general appearance of the book leave nothing to be desired."

The JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION says:

"Within the limits set by the editor the work is, as a whole, interesting and commendable and in its execution a credit to the publishers. Because of its practical, as well as its scientific, character, it should prove a popular text-book for students and a valuable, concise hand-book for the general practitioner."

Dr. James Carroll, Professor of Bacteriology and Pathology will contribute the article upon "Yellow Fever," to appear in Volume 2, of "*Modern Medicine*," a monumental work in seven octavo volumes of 900 pages each to be edited by Dr. William Osler and published by Lea Brothers. The prospectus has just been issued. The various subjects are treated by eminent American, British and Continental authors. Dr. Carroll also contributed the section on "Gelbfieber" (Yellow Fever,) in the "Handbuch der Tropenkrankheiten," a work in three octavo volumes, edited by Dr. C. Mense, of Kassel, and published in Leipsic, 1905. It is an exhaustive presentation of our present knowledge of tropical diseases. It has recently been translated from German into Italian. Dr. Carroll's relation to yellow fever investigations is ably treated in Dr. Donnally's paper in this number.

Dr. Francis R. Hagner, Clinical Professor of Genito-Urinary Surgery and Venereal Diseases, had a paper in the *American Record* of October, on "Operative Treatment of Acute Gonorrheal Epididymitis;" also one on "Tuberculosis of the Bladder and a plea for early diagnosis," in the *Virginia Medical Semi-Monthly*, August 10, 1906.

Dr. J. B. Nichols, Professor of Histology, has made a study of the subject of feeding in typhoid fever, as the result of which he disagrees

with the generally accepted plan of a practically exclusive milk or so-called "liquid" diet and advocates the employment of a more liberal and varied diet than that in general use.

On the basis of published metabolism and digestion studies in actual cases, he has endeavored to work out the theory or principles of typhoid dietetics on the same basis and the same kind of data as have served for the scientific establishment of the recognized principles underlying dietetics in health and infant feeding. By these methods he has determined a standard for feeding typhoid fever patients (2,000 calories of energy and 100 grams of proteid daily) that may be accepted tentatively until further investigations directly to this end may fix it definitely. Digestion experiments were found to show that, contrary to the prevailing belief, the digestive powers in typhoid fever are on the average lowered only five to ten per cent. Consideration of other factors seemed to show that the present fears and objections to soft and solid food are unfounded, and that a mixed diet really is less objectionable than the "liquid" diet now in use.

The actual results of varied and generous feeding in typhoid fever were found to corroborate the conclusions derived from theory. Patients so fed were more comfortable, convalesced in a much shorter time, showed none of the harmful consequences generally feared, and displayed greater resisting power against the disease, as manifested in some comparative series by a difference in mortality of two per cent. in favor of liberal feeding.

Dr. Nichols's paper on the general subject of typhoid dietetics was published in AMERICAN MEDICINE, May 6, 1905, IX, pp. 726-736.

He has also made a study of the historical development and basis of present dietetic methods in this disease (published in the MEDICAL RECORD July 29, 1905, LXVIII, pp. 171-174). He believes that the present methods have developed in a fortuitous and empirical way; have not been based on or subjected to the critique of modern physiologic and dietetic principles; and that there is involved in the present prevalent doctrine a surviving vestige of the ideas that characterized the exploded ancient theory and practice of antiphlogistic therapy.

In the AMERICAN JOURNAL OF THE MEDICAL SCIENCES for July, 1905, CXXX, 120-125, Dr. Nichols gives the first detailed report of a case of protozoa in the stomach occurring in this country. He found only twenty-two other cases of the kind on record, a study of which shows that this condition is to be regarded as a probable evidence of non-obstructive carcinoma of the stomach.

Dr. Nichols has also prosecuted some statistical studies of the relative proportions of the sexes at birth. In a paper published in the AMERICAN ANTHROPOLOGIST, 1905, VII, pp. 24-36, he gives the statistics of the num-

bers of sons and daughters in 3,000 families of six or more children each, from which it appears that the actual distribution of the sexes corresponds with practical exactness to what would be expected from the operation of the laws of chance.

In another study (not yet published) he has collected the statistics of over 700,000,000 births, from which are gathered the relative numbers of males to females born, in living births, stillbirths, and multiple births, in the different countries, among various races, and in connection with such conditions as legitimacy, etc.

The students of the medical department, by the courteous invitation of the Medical Society of the District of Columbia, were given the privilege of listening to the address of Sir Almroth E. Wright, M.D., F.R.S., late Professor of Pathology, Army Medical School, Netley, and at present Pathologist to St. Mary's Hospital, London, before that body on October 12, 1906, at a special meeting called for the purpose.

Dr. Wright's subject was, "Principles of the Treatment of Bacterial Diseases by the Inoculation of Corresponding Vaccines," and for one hour he held the undivided attention of the large number assembled to hear him. In the first part of his discourse he showed that the two plans pursued by the medical profession up to the present time in the treatment of bacterial infections, namely, (1) the use of strong medicines, and later (2) the expectant plan with rest, hygiene, diet and such stimulation as might be needed to keep the heart going, were wrong in principle according to our present knowledge, and were destined never to reach such cases as the ten per cent. of typhoid patients nor the ninety per cent. of plague patients who die, nor the strong man laid by for a year or two in an attack of Malta fever, nor those patients with localized infections such as bone and joint tuberculosis, uterine discharges, lupus, acne, furunculosis and so on. He illustrated further at some length the inefficiency of the present expectant treatment and of local treatment with antiseptics.

Proceeding, he showed that it was within our power to take advantage of the immunizing apparatus with which the animal ecomony is equipped, by inoculation of dead cultures of the infecting bacterium and thus increase the power of resistance of the individual to the invader so that the disease may be overcome. The application of this procedure offers many obstacles to its successful practice. Although Dr. Wright omitted discussion of technique, the major portion of his address was devoted to explaining the effect of these inoculations and the resultant reaction of the individual. He pointed out the necessity of frequent, tedious blood examinations to determine the opsonic index and from this the suitable time for administration, as essential to the intelligent employment of the method.

"Opsonins" are chemical substances in blood serum which sensitize bacteria so that the leucocytes will engulf and destroy them (bacterial phagocytosis). In normal individuals the opsonic power of the blood varies within exceedingly small limits, and the average number ingested by the normal leucocyte is used as a standard and called one. In infections the leucocytic phagocytosis usually differs from the normal, being greater or less, the ratio to the normal phagocytosis expressed numerically is called the "opsonic index." A high opsonic index is always more than one; a low opsonic index less than one. Without the knowledge of the effect of the inoculations harm rather than good is likely to result. Schematic charts were used to elucidate the theory, and charts of actual cases in which Dr. Wright had employed it.

This led to the last part of the address, in which Dr. Wright told of some of his remarkable results. A case which seemed to appeal to his audience more than others was one of "infective endocarditis" in a young woman, secondary to a severe angina, which was regarded by the physicians and surgeons in attendance as hopeless. Both sides of the heart were involved. For weeks she ran an exceedingly high temperature, and the end seemed only a question of a short time. Dr. Wright was called in at this juncture. His first move was to make a blood culture, which resulted in the isolation of a streptococcus from the circulating blood. Then he determined the opsonic index of her blood for this organism. Material for injection was prepared with this bacterium also. Her first inoculation was 5,000,000 dead streptococci of the strain isolated from her blood. By similar inoculations with frequent determinations of opsonic index to guide him, the young woman got well and is living to-day.

Other cases described, showing brilliant results, were pulmonary and joint tuberculosis, lupus, empyema, gonorrheal arthritis, sycosis, acne and chronic furunculosis.

Dr. Wright is a fluent, easy speaker, and such a master of his theme that this complex subject seemed simple as he logically and rapidly unfolded it.

UNIVERSITY APPOINTMENTS.

Beginning with the Academic Year, 1906-07.

Acting Dean of the Department of Politics and Diplomacy, November 1, 1906: Charles William Augustus Veditz, Ph. D.

Ph.B., University of Pennsylvania, 1891; Graduate courses in Economics and Public Law (in Germany), 1891-'95; Halle University, 1891-'93; Berlin, 1893-'94; Leipzig, 1894-'95; Ph.D., (1895), Halle University; Studies in France in Sociology, History and Public Law, Ecole de Droit, 1896-'99 (licencié en droit); Ecole des Hautes Etudes, 1896-'97; Ecole d'Anthropologie, 1896-'98; Sarbonne, 1897-'98; Collège de France, 1898-'00; Collège libre des Sciences Politiques, 1898-'99; Collège libre des Sciences Sociales, 1898-1900. Fellow in Sociology, University of Pennsylvania, 1901; Professor of Economics and History, Bates College, Lewiston, Maine, 1901-'04. Lecturer on Sociology, Bangor Theological Seminary (Maine), 1904-'05; General Secretary and Staff Lecturer, University Extension Society of Maine, 1903-'05; Secretary American Sociological Society, 1906; Editor-in-Chief, Bulletin of the American Economic Association, 1906; Member, American Economic Association, American Academy of Social and Political Science, Council of National Economic League, American Sociological Society, Institute International de Sociologie, Internationale Vereinigung für vergleichende Rechtswissenschaft, etc. Professor of Economics, the George Washington University, 1905.—

DEPARTMENT OF ARTS AND SCIENCES.

Columbian College.

Professor of Botany: Albert Mann, Ph. D.

Ed., Wesleyan University; B.A., ibid, 1879; M.A., ibid, 1882; student in University of Munich, 1892-1894; Ph.D., ibid, 1894; research work, ibid, 1900-1901; Professor of Botany, Ohio Wesleyan Univ., 1895-1900. Expert, Department of Agriculture, stationed at Washington, D. C., 1906.

Librarian of the Department of Arts and Sciences and Assistant Professor of German: Alfred F. W. Schmidt, A.M.

Ed., Mt. Angel College, Oregon, 1889-'91; A.B., Leland Stanford, Jr., University, 1895; A.M., honoris causa, Mt. Angel College, 1900; Asst. in the University Library, Leland Stanford, 1894-'97; Assistant and Instructor in Anglo-Saxon, ibid., 1896-'97; Instructor in German, ibid., 1897-1900; Head Classifier, University Library, ibid., 1900-'01; Assistant Librarian, ibid., 1901; Asst. in Classification Catalogue Division, Library of Congress, 1902-'06; Instructor in German, The George Washington University, 1905-'06.

Assistant Professor of Mathematics: Paul Noble Peck, A.M.

Ed., Emerson Institute, Washington, 1890-'98; A.B., The George Washington University, 1904; A.M., ibid., 1905; Principal, Paducah Preparatory School, 1902-'03; Assistant in Greek and Latin, The George Washington University, 1904-'05; Instructor in Mathematics, ibid, 1905-'06.

Assistant Professor of English: T. DEWITT CROISSANT, A.B.

Student, Columbian College, 1895-'97; A.B., Princeton University, 1899; Graduate Student, University of Chicago, 1899-'01; Instructor in English, University of Colorado, 1901-'02; Fellow, Princeton University, 1902-'03; Student, University of Munich, 1903-'04; Instructor in English, The George Washington University, 1905-06.

Instructor in History: JAMES FREDERICK PEAKE, A.M.

A.B., Randolph-Macon College, 1902; A.M., The George Washington University, 1904; Instructor in Greek, Randolph-Macon College, 1901-'02; Teacher of Latin and English, Randolph-Macon Academy, 1902-'03; Assistant in English, The George Washington University, 1904-'05.

Adviser of Women and Instructor in English: HARRIETT STRATTON ELLIS, A.B.

A.B., Woman's College, of Baltimore, 1892.

Instructor in Chemistry: WALTER OTHEMAN SNELLING, M.S.

B.S., The George Washington University, 1904; B.S., Harvard, 1905; M.S., Yale, 1906.

Instructor in Mathematics: GEORGE ALBERT ROSS, A.M.

A.B., William Jewell College, 1893; A.M., The George Washington University, 1898.

WASHINGTON COLLEGE OF ENGINEERING.

Instructor in Civil Engineering: OSCAR A. MECHLIN, C.E.

B.S., Dartmouth College, 1903; C.E., The George Washington University, 1906; Assistant Engineer, District of Columbia, 1904-'06.

Instructor in Mechanical Engineering: A. C. WILLARD, B.S.

B.S., Massachusetts Institute of Technology, 1904; Principal, University School, San Francisco, 1904-'06.

Instructor in Physics and Electricity: EVERETT W. VARNEY, A.B.

A.B., Bowdoin College, 1899; Assistant in Physics, ibid, 1898-'9.

Instructor in Electrical Engineering: T. F. S. MAGUIRE, B.S.

B.S., Massachusetts Institute of Technology, 1897.

DEPARTMENT OF MEDICINE.

Professor of Nervous Diseases: CHARLES H. CLARK, M.D.

M.D., Starling Medical College, Columbus, Ohio, 1893; House Physician, St. Francis' Hospital, Columbus, Ohio, 1893-1894; First Assistant Physician, Ohio Hospital for Epileptics, Gallipolis, Ohio, 1894-1897. Second Assistant Physician, State Hospital for Insane, Columbus, Ohio, 1897-1898. First Assistant Physician, State Hospital for Insane, Massilon, Ohio, 1898-1899. Second Assistant Physician, Government Hospital for Insane, Washington, D. C., 1899-1906. Clinical Director, Government Hospital for Insane, Washington, D. C., since April 1, 1906.

Professor of Morbid Anatomy: ISAAC WRIGHT BLACKBURN, M.D.

M.D., University of Pennsylvania, 1882; Pathologist to Government Hospital for the Insane, since 1884; Lecturer on Pathology of Mental Diseases, The George Washington University, 1885-'86; Professor of Pathology, ibid, 1886; Professor of Pathology and Histology, ibid, 1889; Professor of Morbis Anatomy and Special Pathology, ibid, 1898;

Member of the American Medico-Psychological Association, Corresponding Member of the Philadelphia Pathological Society; Member of the American Association for the Advancement of Science, and other medical and scientific societies.

Professor of Physiology: SHEPHERD IVORY FRANZ, Ph.D.

A.B., Columbia University, 1894; Fellow, 1895-'99, and Ph.D., ibid, 1899; Assistant in Physiology, Harvard Medical School, 1899-1901; Instructor in Physiology, Dartmouth Medical College, 1901-'04; Pathological Physiologist, McLean Hospital, the Insane Department of Massachusetts General Hospital, 1904-'06; Research Assistant, Carnegie Institute of Washington.

DEPARTMENT OF LAW AND JURISPRUDENCE.

Professor of Law: EDWARD S. THURSTON, A.M., LL.B.

A.B., Harvard University, 1898; A.M., ibid, 1900; LL.B., ibid, 1901; practised law in New York City, 1901-'06; Instructor in Law, Indiana State University, 1906.

Professor of Law: W. C. DENNIS, A.M., LL.B.

A.B., Earlham College, Richmond, Ind., 1896; A.B., Harvard University, 1897; A.M., ibid, 1898; LL.B., ibid, 1901; Secretary, Lake Mohonk Conference on International Arbitration, 1901-'02; Instructor in School of Law, University of Illinois, 1902-'03; Assistant Professor of Law, ibid, 1903-'04; Assistant Professor of Law, Stanford University, 1904-'05; Adjunct Professor of Law, Columbia University, 1905-'06; Assistant Solicitor, Department of State, 1906.

UNIVERSITY MISCELLANEA.

At the celebration of the hundredth anniversary of the founding of the University of Aberdeen, the degree of LL.D. was conferred upon Professor Frank Wigglesworth Clarke, Professor of Mineral Chemistry in the Faculty of Graduate Studies.

Professor Charles E. Munroe has been appointed superintendent of the special alcohol exhibit of the Jamestown Exposition. This appointment was made in recognition of Professor Munroe's standing as a chemical expert.

Professors Yarrow, Carroll, Bovée and Ruffin attended the meeting of the British Medical Association in Toronto last August.

Dr. Yarrow, Professor of Dermatology, was official representative of the University at the opening of the new Harvard Medical School Buildings September 26. Dr. A. F. A. King, Professor of Obstetrics, also was present as the official representative of the University of Vermont.

Dr. George N. Acker, Professor of Pediatrics, delivered the president's address before the Washington Gynecological Society October 5, 1906. His subject was "The Etiology and Treatment of Nervousness in Infancy and Childhood." Dr. Acker was made a member of the Council of the Pediatric Society in May, 1906.

Professor James Brown Scott has issued a prospectus announcing the forthcoming American Case-Book Series, which is to contain collections of cases on thirty of the principal topics now taught in American law schools. These collections of cases are to be prepared by teachers in the different law schools of the country, under the general editorial supervision of Professor Scott. The series will be published by the West Publishing Company, of St Paul, Minnesota.

Professor Scott, who was last March appointed Solicitor of the Department of State, is also to be editor of the American Journal of International Law, the publication of the recently established American Society of International Law. The first number is expected to appear in January.

At the recent meeting of the Association of American Law Schools, held at St. Paul, Minnesota, August 28-30, Professor William R. Vance, Dean of the Department of Law and Jurisprudence, was elected Secretary of the Association for the ensuing year.

Partly in recognition of his services in organizing the American Sociological Society, Professor C. W. A. Veditz, Acting-Dean of the Department of Politics and Diplomacy, has recently been elected a member of the International Institute of Sociology, an honorary organization with narrowly limited membership. Only seven Americans enjoy the distinction, among them Lester F. Ward, Franklin W. Giddings, Carroll D. Wright and Albion W. Small.

At the recent annual meeting of the Medical Society of Virginia, Doctor Bathurst Brown Bagby, '04, read a paper on uncinariasis, or hookworm disease, in Virginia. He presented several patients so affected. Dr. Bagby's cases are the first recognized in the medical history of the state. The appreciation of Dr. Bagby's original contribution was recognized by his election as first vice-president of the Society for 1907. This is an honor never before conferred on so young a member.

The first Fall Convocation of the George Washington University was held on Wednesday, the 17th inst., in Memorial Continental Hall. The purpose of this convocation is to bring together the new and old students of the University and to afford an opportunity for the conferring of degrees upon students who have completed the requirements, but who were prevented from taking part in the regular commencement exercises. The speaker on this occasion was Dr. Carl Beck, Professor of Surgery in the Postgraduate Medical School, University of the State of New York, and President of St. Mark's Hospital, of New York. The subject of his address was, "The Influence of American Medicine and Surgery on Europe," which we take pleasure in publishing in this issue. Dr. M. Ross Fishburn, Pastor of the Mt. Pleasant Congregational Church, acted as Chaplain of this occasion. Degrees were conferred on a number of candidates and debate medals were awarded to successful contestants of the last session.

The *University Hatchet*, our weekly newspaper, is now strictly under student control, as the financial interest in the publication held by individuals has been bought, and the ownership is now vested in a corporation known as "The University Hatchet." The corporation consists of five students and two professors appointed for the first session by the President of the University, namely: Messrs. Wilson, Gates, Call, Moore and Russell, and Professors Carroll and Vance. At a meeting held in June the Board of Editors elected Mr. Robert I. Moore, Editor-in-Chief and Mr. Arthur J. Russell, Business Manager for 1906-'07. Mr. F. P. Gates is Chairman of the Board.

The University Library has been enlarged during the summer both in quarters and in equipment. The entire north end of the first floor, with

the exception of the President's office, has been remodelled and adapted to library purposes. The Germanic library of the late Professor Richard Heinzel, of the University of Berlin, which was purchased by the University last spring, has been received and installed on the library shelves. This library contains 7,200 volumes and pamphlets bearing on German philology and literature and a large number of works and periodicals in cognate branches, especially Anglo-Saxon, Old English, Romance and Slavic languages. Dr. A. F. W. Schmidt, formerly of the Stanford University library staff and of the Library of Congress, recently appointed Librarian, is now engaged in making a catalogue of this important collection of books.

At the annual meeting of The George Washington University Medical Society held in May, 1906, the following officers were elected for the present year: President, Dr. J. W. Chappell, '81; Vice-President, Dr. H. T. A. Lemon, '96; Secretary, Dr. D. W. Prentiss, '99; Treasurer, Dr. L. H. Taylor, '03; Council, Drs. A. Barnes Hooe, '06, H. C. Yarrow, J. Lewis Riggles, '00, T. V. McLaughlin, '82, Thomas A. Groover, '98. The initial meeting of this session was held on Saturday evening, October 20th, in the Medical Building. Dr. Chappell, the President, was in the chair and about eighty members were present. After a brief address by President Needham, the principal paper of the evening was read by Dr. Medford, on "Tetanus: Report of a Case with Recovery," which elicited considerable discussion. Dr. Carr exhibited a bone drill and a bone saw of his own invention. Dr. White presented a brief note on the application of a plaster cast to an open wound. After adjournment the members enjoyed an informal smoker.

The energy and enthusiasm of the University Medical Society is a source of gratification to the whole University. Organized just one year ago with Dr. Hooe as President, it has grown in interest and effectiveness until it now numbers one hundred and twenty members. The majority of the papers presented in this issue of the Bulletin were read before the Society.

The academic year began in Columbian College with a schedule of 219 class and laboratory periods each week. The following appointments have been made on the Faculty:

Albert Mann, Ph.D., Professor of Botany; Alfred F. W. Schmidt, A.M., Assistant Professor of German, and Librarian of the Library of Arts and Sciences; James Frederick Peake, A.M., Instructor in History; Walter Otheman Snelling, M.S., Instructor in Chemistry; Harriett Stratton Ellis, A.B., Adviser of Women and Instructor in English; George A. Ross, A.M., Instructor in Mathematics.

Very important in the College work is the appointment of Miss Ellis as Adviser of Women. She is a graduate of the Woman's College of

Baltimore in the class of 1892. Since her graduation she has been engaged in teaching young women. She has been a successful teacher and administrator. She has twice taken parties of young ladies to Europe for travel and study. She will have in her care the interests of the women students in Columbian College. She has an office in the University Building, and is a member of the College Faculty, offering courses of study open only to the women students. Her appointment is a recognition of the distinctive element of femininity in the education of women.

A modification in the required Freshman work in English goes into effect this year. It is the introduction as a part of that work of a course in Philosophy—the first half-year Logic, the second half-year Descriptive Psychology—furnishing a basis for the scientific study of rhetoric in the study of the laws of thought and mental phenomena. This is taken in addition to the study of rhetoric and the writing of themes throughout the year.

There are modifications and important improvements in various departments of study. A new laboratory has been fitted up for Zoology and Botany, and the Professors in these subjects are offering jointly a course of lectures in Comparative Biology. Professor George L. Raymond is giving a course of lectures on Wednesday afternoons through the first half-year, on the "Influence of Art Upon Human Discipline and Development." The various Teachers' Courses are all well attended and the results attained in this work would have demonstrated the wisdom of making certain lines of University study available to the teachers in the public schools.

The Washington College of Engineering has opened with a larger enrollment than during the previous session. All work in drawing, in the shops, and in the engineering laboratories, and nearly all of the class-room work is now given at Van Ness House, on the new site of the University. Regular shop-work is now a required part of the course, and during the present session a course in wood-work, including pattern-making will be given, and metal work will be added next year. Van Ness House having proven too small for the work of the College, an annex was constructed during the summer in which to house a boiler, an engine, a dynamo and a gasoline engine, which are among the gifts recently received.

Four new instructors have been added this year: Mr. O. H. Mechlin, C.E., Instructor in Civil Engineering; Mr. A. C. Willard, B.S., Instructor in Mechanical Engineering; Mr. T. F. J. Maguire, B.S., Instructor in Electrical Engineering, and Mr. E. W. Varney, A.B., Laboratory Instructor in Physics and Electricity.

Recent gifts to this College are gratefully acknowledged:—

From Mr. Bernard R. Green, Chairman of the Board of Trustees, a forty-horse-power boiler; from the Washington Loan and Trust Company, a dynamo, an engine, an elevator cylinder, a steam pump and tanks, and a collection of miscellaneous pieces for use in the steam engineering laboratory; from the Standard Underground Cable Company, a sample board of cables and wires; and from Mr. A. S. Riddle, Electrician of the Post-office Department, one Eddy motor.

In the Department of Medicine, Dr. W. P. Carr, for a number of years Professor of Physiology and Clinical Professor of Surgery, has been appointed Acting Professor of Surgery, to fill the vacancy caused by the leave of absence granted Professor J. Ford Thompson. Dr. Carr will probably, at the expiration of Dr. Thompson's leave of absence, at which time he has tendered his resignation, be appointed Professor of Surgery.

The vacancy in the Chair of Physiology will be filled during the current session by Dr. Shepherd Ivory Franz. Dr. Franz received his degree of A.B. from Columbia University, New York, in 1894. He took his Doctor of Philosophy Degree at the same institution in 1899. He was a Fellow in Columbia University from 1895 to 1897, and an assistant in Psychology from 1897 to 1899. He was at Harvard Medical as an assistant in Physiology from 1899 to 1901. From Harvard he went to Dartmouth Medical College and was Instructor in Physiology in 1901-04. Since 1904 to the present he has been Pathological Physiologist at McLean Hospital, the Insane Department of Massachusetts General Hospital. He is research Assistant of Carnegie Institute, and has received a grant for carrying on original work. Dr. Franz has done a great deal of original research and his results have been published in the American Journal of Physiology, Psychological Review and other scientific publications. He comes to the school highly recommended as an excellent and interesting teacher. He will devote his entire time to Physiology. Dr. Chas. A. Clark, Chief Medical Officer of the Government Hospital for the Insane, has been elected Professor of Nervous Diseases. Dr. Clark has had considerable experience as a teacher and his long connection with the Government Hospital and other institutions admirably equip him for the work of this department. Dr. I. W. Blackburn, for many years well known to the medical profession as Pathologist to the Government Hospital for the Insane, has been elected Professor of Morbid Anatomy. In this important department he will undoubtedly prove an acquisition to the teaching force of the School.

Some noteworthy changes in the work of the Department of Law and Jurisprudence were made at the close of the last session. The most important of these is the differentiation between those students who

devote their whole time to the study of law and those whose employment in the Government service or elsewhere precludes their attendance upon any lectures until the late afternoon. Heretofore the program of work arranged for candidates for the degree of Bachelor of Laws was so ordered that all of the lectures required for that degree could be taken after 4:30 P. M. and within the three years set by the Association of American Law Schools as the minimum time requirement for candidates for this degree. Experience proved what might have been easily expected; that those students whose employment outside the University consumed a greater part of the time were unable to carry successfully the amount of work that, under modern standards, is reasonably required for the degree of Bachelor of Laws. Therefore, in order to secure to this class of students, which has always been numerous in Washington, the advantages of a sound and thorough training in the law, it was decided to permit them to take only three-fourths of the work required each year of the students devoting their whole time to their legal studies. This end is accomplished by giving in the afternoon only nine of the twelve hours of work required each year. Six hours of the lectures for each year will be given in the forenoon. By altering the subjects given in the forenoon and afternoon respectively, students who can attend only afternoon classes will be enabled in four years to complete the amount of work required for the degree.

This change puts this department on a basis of full day work, and will enable the Faculty to fix the standard of work, both as to extent and as to thoroughness, at a level equal to that now maintained by the leading law schools of the country.

The so-called "case method" of law teaching grows in favor, both with the members of the Faculty and with the student body. Collections of cases are now used as the basis of instruction in most of the subjects taught.

The graduate courses offered to students who are candidates for the degree of Master of Laws have been greatly extended, and increased by the addition of courses in Taxation, Extraordinary Legal Remedies, Railway Law, Brief Making, Spanish-American Law and Mortgages. In addition to these, Professor Scott is conducting a weekly seminary in International Law. These graduate courses are intended chiefly to meet the needs of the increasing body of students who come to Washington after graduation in law from the various State universities with the purpose of taking advanced work in law in this University.

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EDITORIAL NOTE.

The George Washington University Bulletin is published four times a year, under the editorial supervision of the Board of University Publications, appointed by the President's Council. It is the purpose of the Council to make the Bulletin an organ of the educational and scientific activities of the University. The University Catalogue constitutes one number. Others are devoted to information of special interest to the Alumni and patrons of the University. Scientific numbers are published from time to time containing contributions from instructors and graduates and information regarding books, monographs and papers published by them under other auspices.

The present scientific number is devoted to the Faculty of Graduate Studies and especially to the departments of natural and physical science. A number of papers from members of the faculty and abstracts of theses accepted for higher degrees are presented. It contains also: The second annual Supplement to the University Bibliography published Sept. 1, 1904, being a record of works and papers published since Oct. 1, 1905, by members of the faculty and Ph.D. graduates; notes bearing on investigations and researches made by instructors in this department; announcements of recent appointments, and miscellaneous items of University interest. The Board desires to be kept informed as to the academic record, publications and professional appointments of instructors and graduates in all departments of the University. Communications may be addressed to the Director.

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The George Washington University
BULLETIN

Vol. V. December, 1906. No. 4.

THE REMARKABLE STORY OF A GREEK FISH, THE GLANIS.*

By Theodore Gill, M.D., Ph.D., LL.D., etc., Professor of Zoology.

Among the most characteristic types of North American fishes is the group of Ictalurines, whose members are chiefly known as catfishes, These are smooth-skinned forms with the anus about midways between the snout and caudal fin, or nearer the latter, the head furnished with eight barbels, the back with a well-developed spinigerous fin as well as an adipose, and the anal fin moderately long. There are many species and those best known have long been celebrated for the care one of the parents takes of the eggs and young.

A type equally characteristic of central and northern, and still more of eastern Europe, is that best known in Germany as the Wels and in Russia as the Som; *Silurus glanis* is the scientific name. It is also a smooth-skinned fish but the anus is very much nearer the head than the caudal fin and consequently the tail is very long; the head is furnished with only six barbels, the nasal pair being absent; the back has a small contracted fin with a very weak spine and there is no adipose fin; the anal fin is extremely elongated. Unlike the North American catfishes, the species exercises no care of either the eggs or young, the female merely "scooping with her tail a hole" in which she deposits her eggs and she, as well as the male, after fertilizing them leaves them without further care.

From time immemorial the fishermen of northern Greece have known a fish which, in olden days they called *Glanis* and which they still desig-

*The University is indebted to the Smithsonian Institution for the use of the figures illustrative of this article; they were prepared for an article on "Parental Care Among Fresh-water Fishes," by Prof. Gill, to be published in the Smithsonian Report for 1905. The figures are made from one of the type specimens presented by the Museum of Comparative Zoology to the U. S. National Museum. The other specimens and especial types are still retained by the Museum of Comparative Zoology.

nate by names of the same origin. Many detached data were recorded about its habits and characteristics by Aristotle. When ichthyology had been given the general framework it now has, and the fishes of northern Europe had become better known than those of southeastern, the *Glanis* was unhesitatingly identified with the Wels, and *Silurus glanis* was the name given to the fish of the north in token of that assumed identity.

Fig. 1.—The Glanis (Parasilurus Aristotelis).

The fullest information we possess, up to the present time, respecting the habits of the Grecian fish was that furnished by Aristotle in his History of Animals. This, however, was not in a continuous form as in modern works, but scattered through a number of "books" and chapters treating of different structures, parts, and functions. These items are of sufficient interest and importance to merit reproduction here. The chief passages are given in the form of translations from the Greek by Professor Louis Agassiz, who doubtless enjoyed the advantage of cooperation of his friend, Professor Cornelius C. Felton, a renowned Greek scholar,* and finally president of Harvard University, who helped to procure his specimens. For the shorter passages the present writer is responsible. This summary will give a good idea of Aristotle's treatment of zoological matters.

In a chapter (I, 5, 3)† on the members and movements of animals, there is an incidental allusion to the *Glanis*, implying that it was familiar enough to serve as a term for comparison. The Kordylos [a Salamander], it is stated, "swims with both its feet and tail, and (to compare small things with great) it has a tail like the *Glanis*."

In a chapter (II, 9, 4) on the characteristics, and especially the bran-

*Felton's "Greece, ancient and modern," in two volumes, 1867, is still one of the best and most interesting works on Greek life.

†The three figures within parentheses indicate the book (I, etc.), the chapter (5, etc.), and the section of the chapter (3, etc.), of the History of Animals.

chiæ of fishes, it is stated that some "have four branchiæ, all divided except the last, as the Kichle [Wrasse], Perke [Perch], *Glanis*, and Kuprinos [Carp]."

A chapter (II, 11, 7) is devoted to the internal parts of sanguineous or vertebrate animals and, in a section (7) on the gall-bladder, it is said that in some fishes "the gall is placed upon the liver, as in the Galeodes [ordinary sharks], the *Glanis*, the Rhine [Angel-fish], the Leiobatos [skate], the Narke [torpedo], and in some long fish, as the Enchelys [eel], the Belone [pipe-fish], and the Zugaina [hammerhead shark]."

In the sixth book (VI, 13, 2 to 4) the manner of spawning is described as follows:

"The fresh-water fishes spawn in the still waters of rivers and lakes among the reeds, as the Phoxinos [minnow] and the Perke [yellow perch]. The *Glanis* and the Perke give out their spawn in a continuous string, like the frogs: and, indeed, the spawn is so wound up that the fishermen reel it off, at least that of the Perke, from the reeds in lakes. The larger *Glanis* spawns in deep waters, some at the depth of a fathom; the smaller in shallower places, especially among the roots of willows or some other tree, and also among the reeds, or the mosses.

They copulate, sometimes a very large with a very small one, and bringing the parts together which some call the navel, and through which they discharge the seed, the females the eggs and the males the sperma. All the eggs that are mingled with the sperma become generally on the first day white and larger, and a little later the eyes of the fishes become visible. These at first, in all fishes as also in other animals, are early conspicuous on account of their size. And those of the eggs that the sperma does not touch, as in the case of sea fishes, are useless and sterile.

But in these fertile eggs, as the fishes grow larger, a kind of husk separates. And this is the envelope that incloses the egg and the young fish. When the sperm has mingled with the egg, the spawn becomes more viscous among the roots, or wherever it may have been deposited. And where the greatest quantity is deposited, the male guards the eggs and the female, having spawned, departs. The growth of the *Glanis* from the egg is very slow, wherefore the male keeps watch forty or fifty days, that the young may not be devoured by the fishes that happen to be in their neighborhood."

Aristotle incidentally adds, in subsequent paragraphs, that "the eggs of the *Glanis* become as large as the seed of the orobos" (S. 5)—that is, the millet—and that none of the fresh-water fishes "except the *Glanis* watch their eggs" (S. 6).

How the eggs are taken care of after spawning, and later the young, is told in a subsequent book (IX, 25, 6):

"Of the river fishes, the male *Glanis* takes great care of its young. For the female, having brought forth, departs, but the male, where the greatest deposit of eggs has been formed, remains by them watching, rendering no other service except keeping off other fishes from destroying the young He does this for forty or fifty days, until the young are sufficiently grown to escape from the other fishes. And he is known to the fishermen wherever he may chance to be watching his eggs; for he keeps off the fishes by rushing movements and by making a noise and moaning. And he remains by the eggs with so much of natural affection that the fishermen,

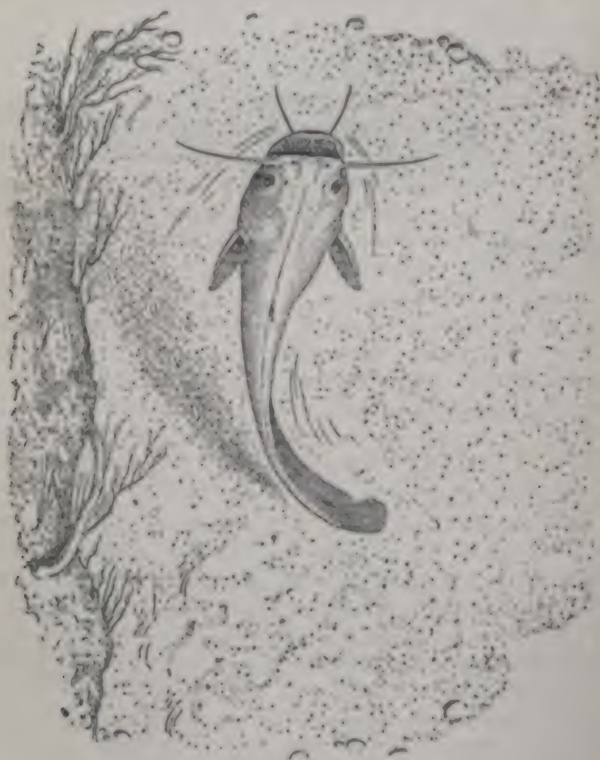

Fig. 2.—Nest of the Glanis (Ideal).

when the eggs adhere to deep roots, bring them up to the shallowest place they can; but he does not even then leave his offspring, but if he chance to be a young fish, he is easily taken by the hook, because he snaps at all the fishes that approach him; but if he is already accustomed to this, and has swallowed hooks before, he does not even then desert his young, but breaks the hook by a very strong bite."

The hooks so easily broken must have been very different from those of our days!

In a chapter (VIII, 20, 12) on the agencies affecting the health of animals, the *Glanis* is also mentioned in the paragraph thus translated by Agassiz:

"The river and lake fishes are exempt from pestilential diseases, but some of them have peculiar disorders, as the *Glanis*, which, about the time of the dog star, by reason of swimming on the surface, becomes sunstruck, and is stupefied by loud thunder, and many *Glanides* in shallow water perish by the bite of [water] snakes."*

One passage relative to the *Glanis* (VIII, 29, 5) has been overlooked by Agassiz and is here translated from the original Greek.

"River and pond fishes are best after spawning and milting, when they have recovered their bodily vigor. Some are good during the spawning season, as the Saperdis; others bad, as the *Glanis*. The males of almost all species are better than the females, but the female *Glanis* is better than the male."

Such was the first original account of the Grecian Glanis as well as the last for very many years. The various later references to it were merely incidental or based on Aristotle. Indeed, about twenty-two centuries were destined to elapse before anything more was known of the fish. Meanwhile, the account became discredited and the species was regarded as identical with the Wels of the north.

In 1839, two of the greatest ichthyologists of the last century, Cuvier and Valenciennes,† regarded this account with great skepticism and recapitulate it, concluding with this opinion:

"What Aristotle relates in detail, and in two passages, of the care which the male Silurus takes of the eggs of his female, borders a little on the marvelous. According to him, the large Siluri deposit them in deep waters; the smaller among the roots of willows and other trees, among the reeds or even the mosses. The female, having laid them, leaves them, but the male guards and defends them, and, *as these eggs are long in hatching*, he continues this care forty or fifty days."

This skepticism was not all unnatural in view of the fact that the French naturalists thought there was no doubt that the Aristotelian fish was specifically identical with the *Silurus glanis* of central Europe; "On ne peut douter que notre silure ne soit le Γλάνις d'Aristote," they ex-

A curious version of this passage was made by R. Creswell in his translation of the History of Animals. " * * the Glanis, from its swimming near the surface, appears to be star-struck by the dog star and it is stupified by loud thunder * * * The Glanis, in shallow water, is often destroyed by the dragon-serpent."

†Histoire Naturelle des Poissons, t. 14, pp. 350, 351

claimed (p. 344). This opinion was confirmed, they thought, by the fact that the Silurus is called at the present day *Glanos* or *Glano* in Turkey. Fifty-six years later (1895) another eminent European ichthyologist (Prof. F. A. Smitt) declared that "the ancient account of Aristotle, that the male hatches the roe, is now regarded as dubious."

It may be now recalled that the *Silurus glanis* does not care for its eggs but, after depositing and fecundating them, the parents leave them to Dame Nature. The skepticism of naturalists respecting the statements of Aristotle was then quite natural as long as there was supposed to be no structural difference between the common Silurus and the Glanis of the Achelous.

From the fourth century before the Christian era a leap may be made to the latter half of the nineteenth and into a new world.

America is not inhabited by any species of the same group or even subfamily as the Glanis, but, as already indicated, has numerous representatives of the same family and of a subfamily quite closely related to the Silurines. Species are found almost everywhere in the streams and lakes of eastern America and the valley of the Mississippi, and are generally known as catfishes. It was also long known that some at least exercised care of their eggs and young. It was therefore quite natural that one familiar with the Wels in Europe as well as with the catfishes of America, Prof. Louis Agassiz, should accept with implicit faith the account of the ancient naturalist, and at the same time be skeptical as to the correctness of the identification of the Grecian fish with that which he had well known in central Europe. In 1856 that naturalist received specimens of a Silurid from the same river (Achelous) from which Aristotle had secured his Glanis, and these were evidently of the same kind as that described by the old naturalist. The specimens, on comparison with some of the Wels, were found to be quite different, the species was named *Glanis Aristotelis*, and an interesting account of them, in the form of translations from Aristotle, was presented to the American Academy of Arts and Sciences and published in their "Proceedings" (III, pp. 325-334).

In this long account, however, no indication was given of any structural differences between the Grecian and German fishes, and consequently for half a century the species has been ignored by European naturalists. Indeed, in the latest English work on fishes (The Cambridge Natural History, Vol. VII, p. 593, 1904) the great ichthyologist, Dr. George Boulenger, expressly affirms that the "only European representative of the family" Siluridæ is the *Silurus glanis*. Nevertheless, in 1890, in response to the present writer's demand for information,* Samuel F. Garman published a description of the specimens collected and commented on in 1856.

*A notice of "The Greek Catfish or Glanis" was published in "Forest and Stream" for October 2, 1890, recapitulating what had been written by Aristotle and Agassiz, and calling for further details.

and called the species "*Silurus* (*Parasilurus*) *Aristotelis*." It appeared that "from the young of *S. glanis* L. of equal length, they are readily distinguished by the possession of four barbels instead of six," as well as "by the difference in shape of those on the maxillaries—they being shorter, less compressed, and more threadlike, by the wide separation in the middle of the band of vomerine teeth, by a larger eye, by a greater slope to the sides of the head, by a smaller dorsal, by the smaller number of rays in the anal, and by the markings." The largest of Mr. Garman's specimens was "less than 9 inches in length." All these characters the present writer has been able to confirm. Furthermore, the snout is more convex in front transversely than in the Wels, the chin barbels further from the symphysis than the foremost ones of the Wels, and the opercles are smaller and especially shorter.

Fig. 3.– Upper view of head showing contour, barbels and large eyes.

Such characters evidently indicate specific differences from the central European fish. Had Agassiz only added to his account one word, *four-barbeled*, Felton would have been justified in his exclamation, made after the communication of Agassiz:

"It is a very striking fact that the fish in question should, so many centuries after the death of Aristotle, have come from the Achelous across the Atlantic to this country, to furnish our associate with a commentary on the great philosopher, and to vindicate his accuracy as an observer against the criticism even of a Cuvier."

The single word "four-barbeled" would not only have demonstrated (accuracy being conceded) that the *Glanis* was distinct from the Wels, but would have suggested to the well-informed ichthyologist that its affinities might be with certain eastern species rather than with the northern. The *Glanis* is, indeed, but distantly related to the Wels of the north and is a near relative of several Asiatic species. It is, in fact, the offspring of

a successful invasion from Persiawards and the Orient. Doubtless the renowned ichthyologist appreciated and intended to have made known these facts, but postponement only anticipated non-performance. Not only did no European ichthyologist take cognizance of Agassiz's communication but a Grecian ichthyologist (Nicolas Chr. Apostolides) who published several articles on Grecian fishes, did not recognize the *Glanis* as a distinct species. In a catalogue of the fishes of Greece,* Apostolides merely enumerates the "*Silurus Glanis*" with Grecian synonyms known to him—"*Γλάνις* d'Aristote, Vulg. *Γλανός* à Vrachori, *Γουλιανός* à Larisse, il abonde dans le Pénée."

In fact, the only authors who have enumerated the *Glanis* among Greek fishes as a distinct species are two Americans, Horace Addison Hoffman, now Professor of Greek in the University of Indiana, who visited Greece in 1890, and David Starr Jordan, President of Stanford University and the eminent ichthyologist; the former made a considerable collection of fishes while resident in Greece and the later identified them for "A Catalogue of the Fishes of Greece," published in 1892. In that catalogue (Proc. Acad. Nat. Sc. Phila., 1892, p. 241-242) the *Glanis* is named as the "*Parasilurus Aristotelis* (Agassiz)" and abstracts of the observations by Aristotle are added.

Well then may the history of the *Glanis* be declared to be unique in the annals of ichthyology. A more detailed account of its habits was given of it than of any other fish by the greatest of ancient scientific authors, but the fish itself was lost sight of or confounded with another for more than a score of centuries. Then it was reserved for a naturalist of a new world to attempt to revive it, and to a follower of his still living to establish it as a distinct species and to tell us what it really is, while in its own country it remains unknown as a peculiar species.†

The modifications of the ancient name *Glanis* are tolerably numerous. According to Apostolides *Glanos* is a common form (especially at Vrachoir) and Cuvier and Valenciennes had long before recorded that *Glanos* and *Glano* are still current in Turkey. Dr. Roeser, in 1856 the "first physician to their majesties, the King and Queen of Greece," sent "specimens labelled *Γλανίδια* (*Glanidia*)" from the Archelous and Prof. Felton, the famous Greek scholar and twentieth president of Harvard University, found that "the local name still preserved among the fishermen, in the

*La Pêche en Grèce—Ichthyologie, Migrations, Engins et Manières de Pêche, Produits, Statistique et Legislation—Athènes, 1883, p. 31.

†One of the most desirable fields for investigation at the present day, so far as the fishes are concerned, is Greece. The only enumerations of its species are very superficial and even, it must be added, deficient in accuracy. Doubtless, by a thorough examination and careful gathering of vernacular names in connection with the fishes themselves, most of the species mentioned by Aristotle and other ancient writers might be properly determined. Hoffman and Jordan have made an excellent beginning but there is necessity for another investigator with more time and opportunities than Hoffman enjoyed.

same region in the north of Greece, is Γλανίδι, formed, according to numerous analogies, from the genitive Γλάνιδος; and the plural of Γλανίδι is Γλανίδια, the word employed in the catalogue accompanying the specimens" sent to Aggasiz. An additional modification, Γουλιάνός appears to prevail at Larissa, where it is abundant in the Penēus river, according to Apostolides (1883).

Aristotle, as usual, did not indicate the habitat of the *Glanis*. The specimens sent to Agassiz were "caught in the Achelous, the chief river in Acarnania, from which locality," Agassiz assumes (p. 332), "Aristotle himself had derived his information about the *Glanis*." According to Apostolides and Hoffman * it is also "caught in the Penēus river and "at Vrachori." These places are now mostly known by other names. The Achelous is the Aspropotamo; the Penēus the Salamvria, and Lake Vrachori or Vrakhori is also called Agrinion and was the Teichonis of the ancients.

Now that attention is once more recalled to the *Glanis*, let us hope that it may be wrested still more from the obscurity in which it has been so long enveloped.

Lexicographers have been no more fortunate in the treatment of the word Glanis that naturalists with the fish. If any old edition of the great dictionary of Liddell, Scott and Drisler is consulted, Γλάνις will be found to be defined as "a kind of shad!" This dictionary, it will be remembered, is "based on the German work of Passow" and he probably† defined it as *eine Art Schaden* or *Schaiden*. This word does not mean Shad but is the South German name for the Wels. Pape defined Γλάνις as *eine Art Wels* and this is substantially correct.

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*Hoffman did not secure specimens.

†The original Passow's dictionary is not at hand.

RECENT PROGRESS IN ASTRONOMY.

By Edgar Frisby, M.A., Professor of Astronomy.

Notwithstanding the fact that Astronomy is the oldest of all the sciences, it will probably be not very far from the truth to assert that observational and theoretical astronomy in its higher development does not date back of the last century. We cannot ignore the fact that a great many advances were made before that time, but most of them were sporadic, accidental and isolated. There were undoubtedly many very great and successful astronomers in ancient and medieval times; we might mention such names as Copernicus, Tycho Brahe, Kepler and Galileo, but no very great advances could be made in solving the riddles of the universe, until its elementary laws were discovered by Newton; and even after his time it required more than a century of effort before these laws could be put into analytical form and developed. We owe our modern analysis to the genius of men like Laplace, who wrote his great work "*The Mecanique Celeste,*" about the beginning of the nineteenth century. It is true that he was preceded by men like Euler and Lagrange, and he undoubtedly owed a great deal to them, still he seems to have made a more complete and systematic presentation of the case than did any who had gone before him. Newton gave the law, Leibnitz, Des Cartes and others invented the methods and symbols used in modern analysis, and Laplace put everything into practical form for investigation and computation. Since his time there have been many workers who have extended and simplified his methods; among these may be mentioned Pontecoulant, Delaunay, Hansen, Le Verrier, Gylden, Poincaré and our own G. W. Hill, and it seems almost difficult to imagine that much more can be done in pure theoretical astronomy. The field is certainly inviting, but the problems are necessarily so intricate and difficult that it seems now, as if very little further advances could be made in this line, unless some very brilliant genius should invent a more powerful and simplified method of investigation than any that has been developed up to the present time.

Before the invention of the telescope by Galileo in 1610 very great progress in observational astronomy was not to be expected, but even after that, progress was very slow for a time. Galileo discovered the four satellites of Jupiter, and Saturn's rings soon after the invention of the telescope; Huyghens, in 1655 discovered Titan, the largest of Saturn's satellites, and Cassini discovered four others before 1700. Still with these exceptions, and a few comets, it can be stated that no discoveries were made in the solar system until the time of Herschel near the end of the eighteenth century, and at the beginning of the nineteenth, for he discovered Uranus in 1781, and two satellites of Saturn in 1789.

Not one of the smaller planets or asteroids as they are called was discovered until the nineteenth century. As a matter of fact, the first one of the group was discovered by Piazzi at Palermo on the first night of the century, January 1, 1801. It had been suspected for a long time that there was a planet between Mars and Jupiter which had hitherto escaped detection, and an association of twenty-four astronomers, mostly German, and of which Baron de Zach was the president, was organized to look for the missing planet, or as one of their number stated, the association was formed for the purpose of forcing this planet from the regions of analogy to the realms of space. They all failed, however, during a dozen years of search, and the first planet of this group was discovered by one who was not a member of the association. The distances of Mercury, Venus, Mars, Jupiter and Saturn from the sun seemed to conform to an empirical law first announced by Professor Bode, of Berlin, in 1772. It was found also that the new planet Uranus conformed to this law. There was, however, an exception to the law since there was a vacant place in the series between Mars and Jupiter. While this Association of Astronomers was looking for this supposed planet, Piazzi was observing for a catalogue of stars. No definite star charts had at this time been constructed so he observed a number of stars in the neighborhood of the ecliptic, and carefully computed their places on successive nights, and after this laborious method, he at last saw a star which he had not previously mapped. There was nothing to distinguish it in appearance from any other star, except the fact that it had not been previously observed. Its position was therefore observed during several successive nights whenever possible, until he was taken ill, and when he recovered, the planet had become lost in the neighborhood of the sun. It was then, that the celebrated mathematician Gauss undertook the problem of computing the orbit of a planet from three complete observations, or from four observations, two only of which were complete. This work was a entire success, enabling de Zach to rediscover this planet by the end of the year, and Olbers, independently, on the next evening, just one year after its first discovery by Piazzi. After many revisions and much labor Gauss finally published his great work "*Theoria Motus Corporum Celestium, Etc.*, in 1809. This work was a complete discussion of the problem in all its bearings, and will always be unique as a masterpiece leaving, in theory at least, nothing more to be desired. The new planet was named Ceres. Pallas was discovered in 1802; Juno in 1804, and Vesta in 1807; all of them lying in the path between Mars and Jupiter, and for nearly forty years afterwards it was supposed that these four were the only members of the group, Astrea, however, was discovered in 1845, and Hebe in 1847, since which time not a single year has elapsed without at least one new member being added to the list, until at the present time there are 633 definitely known and numbered, of which 569 have received names, and as there are many more whose orbits have not as yet been definitely determined, and as it is not absolutely known at

present how many of these are really new ones, it can fairly be stated that there are in the neighborhood of seven hundred of these small bodies, all revolving around the sun between the orbits of Mars and Jupiter, their inclinations and eccentricities on the average being much greater than those of the larger planets. Eros, number 433, and one lately discovered, having by far the greatest eccentricities, will probably give the most accurate value of the solar parallax, from which the distance of the earth from the sun can be computed.

A great many of the Asteroids were discovered by comparing the positions of stars in the heavens with previously prepared charts in the neighborhood of the ecliptic. It was by this method that Watson of Ann Arbor, Peters, of Clinton, New York, Palisa, of Vienna, and Luther of Düsseldorf discovered so many.

During recent years, however, most of the new planets have been discovered by photography, principally by Charlois at Nice, and by Wolf at Heidelberg, who first applied this method in 1891. The photographic telescope is moved by clock work, so as to keep pace exactly with the stars, so that an exposure can be made for two or three hours if necessary, and the stars will all appear like black dots on the negative, while any object that has any motion independent of the stars will appear as a streak. Satellites of planets can also be found in this way, if the moving telescope is so adjusted as to keep pace with the apparent motion of the planet. There are several advantages in this method of observing, one being that the telescope does not get tired with a long continuous exposure as the human eye does. Another great advantage is that by the action of the ultra violet rays, to which the photographic plate is especially sensitive, objects can be reproduced on the plate which are invisible to the eye, consequently it often happens that objects which are too faint to be seen with a telescope by the visual rays are photographed and then seen when developed on the photographic plate.

It was stated some time ago that Wolf had never seen one of all the asteroids he had discovered. It some times happens that several of these trails are seen on the same plate, and of course old as well as new asteroids appear on the plates. On all the plates taken at Heidelberg, during the last five years, the ratio of new to old asteroids is about in the ratio of 10 to 27 or 28, and the number of new ones actually being discovered does not appear to diminish from year to year; at least twenty or thirty new ones seem to be discovered each year, and we do not know when it will end. A little over a century ago, the members of the distinguished Association of twenty-four Astronomers were diligently searching for an asteroid for a period of twelve years and failed entirely, now it often happens that several are found in a single night. Some years ago when there were only about 140 known I heard Professor Watson say he thought it impossible that more than 200 could be found. This shows that distinguished people may be mistaken when they begin to predict.

The next discovery of any note was that of the planet Neptune by Galle of Berlin, in 1846. It had been noted that the orbit of the planet Uranus could not be reconciled with previous observations made before its recognition as a planet by Herschel, and that the most refined calculations were insufficient to account for its motion. In addition to that, its more recent motions could not be adequately accounted for, when the perturbations by Jupiter and Saturn were taken into account. As the theory of their motions and their masses had been pretty well determined, Le Verrier at Paris, and Adams at Cambridge, almost simultaneously and without the knowledge of each other, and by entirely different methods tried to solve the following problem: "Given the deviations from the computed and observed positions of a planet at different times, to find the mass, distance, and all the elements of the disturbing planet." It was evidently a very difficult problem; the use of a great many observations being necessary, the residuals or differences between the computed and observed positions being the known quantities and all the elements of the disturbing body entering as unknown quantities into a series of complex equations almost unmanageable. Both workers however, assumed that its distance was in accordance with Bode's law, which assumption afterwards proved to be very far from the truth. Le Verrier was the first to announce the results of his computations to the world, and he wrote to Dr. Galle at Berlin requesting him to look in a certain portion of the heavens for the new star, saying that he would find it within a degree of the place. It was found by Dr. Galle within half an hour after the search commenced, and within less than one degree of the place. It was supposed at the time, and justly so, to be a triumph of mathematical genius and a complete verification of Newton's law of gravitation. It is, however, more than likely that it was a fortuitous circumstance that the planet was so near to the predicted place at that time. It is also pretty certain that Adams was entitled to his share in the honors, for he had previously predicted the planet's place, and it had been observed in England some time before its discovery in Berlin, but the observations had not been reduced. It certainly would have been found in England, if the English observers had been as expeditious as the German ones. Both of these mathematicians are equally deserving of the highest honors, and posterity has not failed to give it equally to them, although Le Verrier's name will be more closely connected with it, as the discovery was directly made at his suggestion.

Of recent discoveries we may mention that of the eighth Satellite of Saturn by the elder Bond at the observatory of Harvard College in 1848. This was, however, the seventh Satellite in the order of distance from the planet; the eighth one in distance having been known for upwards of 150 years. The two very small Satellites of Mars were discovered by Professor Asaph Hall at the United States Naval Observatory in August 1877, with the new 26-inch telescope built by Alvan Clark. They were both discovered on the same evening. They are each very small objects, the

nearer one having a period of about 7 hours, 39 minutes, and the outer one a period of about 30 hours and 18 minutes, so that the inner one, with respect to Mars, will appear to rise in the west and set in the east, completing its apparent motion in about 11 hours; the outer Satellite rises in the east and sets in the west like all the other heavenly bodies, but it takes nearly 132 hours to perform this diurnal circuit, or nearly four times as long as its motion around Mars. The physical appearance of the planet Mars is interesting, for in addition to its general ruddy appearance, its polar caps, and its various shadings of orange and yellow, Schiaparelli discovered in 1877 and 1879 that there were a number of straight lines or canals, as he called them, crossing the planet in all directions and in 1881 he announced that some of them were double. This was so remarkable that it was doubted for some time whether they really existed or were subjective phenomena but the later observations of Lowell at Flagstaff, Arizona, seem to have abundantly proved their reality. Still they cannot be seen except in very clear regions, such as the bright, clear Italian skies, or those of the mountains of Arizona, or probably still better on the elevated plateau of Arequipa, Peru.

The next discovery of any note in the Solar System, was that of the fifth Satellite of Jupiter, by Barnard, with the 36-inch telescope of the Lick Observatory, in September, 1892. This is an extremely faint object and can be seen only with very large telescopes, and it is so very near Jupiter that it is almost always within its rays. It can only be observed with such instruments as the Lick and Yerkes Telescopes. It can barely be seen under very favorable circumstances with the 26-inch at Washington, but it is certainly beyond its power for continuous observations. Its period of revolution around Jupiter is about 11 hours, 57 minutes and 4 seconds.

The sixth Satellite of Jupiter was discovered by Perrine at the Lick Observatory, on January 5, 1905. This was the first visible observation, but Miss Leavitt, of Harvard College Observatory, on examining the plates of Harvard University on December 10th, 1904, found that she had already marked this sixth Satellite many times, but had thought that it might be an asteroid. It was very remarkable that it had been previously examined by her in 1894 and was found on nine plates taken during the year 1904. Its inclination to the ecliptic and the planet's equator is about 30 degrees. Its period of revolution is about 250 days, and its distance from the planet about 7,000,000 miles.

The seventh Satellite of Jupiter was also discovered by Perrine at the Lick Observatory on February 25th, 1905. It is exceedingly faint, of about the 16th magnitude and can only be seen with the very largest telescopes. It is estimated from photographs that it cannot be more than 35 miles in diameter.

The ninth Satellite of Saturn was discovered by Wm. H. Pickering,

in 1899, from an examination of photographic plates taken with the 24-inch Bruce Telescope at Arequipa. He describes it as a new and faint Satellite of Saturn, having a period of about a year and a half. A further discussion of a large number of photographs served to determine the elements of its orbit. Eleven photographs taken by Mr. Frost at the Arequipa station, under the direction of Professor Bailey, enabled the astronomers there to follow the satellite from April 16th, to June 9th, 1904, and to correct its ephemeris. A full discussion appeared shortly afterwards in the annals of the Harvard Observatory, when an ephemeris was published with its approximate position, angle and distance for the purpose of enabling astronomers to look for it. It was visually observed by Barnard with the Yerkes telescope at Williams Bay, Wisconsin, on September 12th, 1904. Barnard gives its magnitude as 16.7. On August 8th, however, it is stated that he and Professor Turner of Oxford, England, who was on a visit to this country at that time, saw an object with the 40-inch Yerkes telescope resembling a star of the 15.5 or 16th magnitude. On September 3rd the object was missing, and he concludes that the August observation was the first visible observation made. Its position was not recorded, and it certainly seems somewhat remarkable that astronomers were able to trace its path for five years or more, when it could not be visually observed. It has been named Phoebe and is supposed to be variable, probably varying from about the 16.5 to 18.0 magnitude. I am not aware that it has been seen by any one but Barnard and Turner

On August 28, 1905, Wm. H. Pickering discovered the tenth Satellite of Saturn, which has been named Themis, at the Harvard College Observatory from an examination of photographs taken with the 24-inch Bruce telescope. Thirteen photographs were examined and the new satellite was found to have a period of about 21 days. Its distance from Saturn is slightly less than that of Hyperion, which had previously been supposed to be the seventh satellite in distance from Saturn. This new satellite is said to be about three magnitudes fainter than Hyperion. Unlike Phoebe it seems to show no sign of variability, and remains continually about the 17.5 magnitude, a little fainter than the mean brightness of Phoebe, and it must, therefore, remain invisible to the human eye, until larger telescopes are constructed. It has never yet been seen, still it is known to exist. Assuming that the intrinsic brightness of a unit of surface is the same throughout the whole Saturnian System, and that the largest satellite (Titan), whose diameter has been measured microscopically, is about 2,300 miles, it follows from their relative brightness that the diameter of Phoebe is about 42 miles, and that of this tenth satellite about 38 miles. It has been computed that a ball rather less than an inch in diameter observed at a distance of 3,000 miles would reflect about as much light as Phoebe or Themis.

In addition, two of the four Satellites of Uranus were discovered by Lassell, in 1851, and he also discovered the one Satellite of Neptune, in 1846, soon after the discovery of Neptune itself.

The number of comets is immense, and it seems almost certain that most of them move in nearly parabolic orbits around the sun and that they will never again be seen by us. Most of them are invisible to the naked eye, and can only be observed telescopically, for a short time near perihelion. There are, however, about 18 or 20 that have orbits so well known that they have been observed at different returns. Some appear to have such elongated elliptic orbits that it may be many hundred years before they are again seen. Among these may be mentioned the Comet of Donati in 1858, whose period is quite uncertain, but supposed to be no less than from 1,800 to 2,400 years, and possibly even greater than that. The comet of 1882, first observed by Finlay at the Cape of Good Hope, was well observed for a period of over seven months. It seems almost certain that its period is a little less than 800 years. My own observations and calculations extending over a period of more than a month gave a period of about 793 years. Others give results varying from about 750 to 812 years. Its perihelion distance was less than the radius of the sun, and it described an arc of 180 degrees in *true anomaly* in about three and one-half hours. About a month after the first observation its nucleus seemed to separate and divide into four or five different nuclei, and it is probably owing to this fact that these slight discrepancies arose as different observers considered either one of these four or five condensations as the central nucleus. The number of comets observed so far during the present year is nine, none of which has been seen with the naked eye.

The greatest advances, however, in astronomy has been made with the spectroscope. Since the discovery by Kirchhoff in 1859 of the laws upon which spectrum analysis depends, there seems to be no practical limit to the discoveries which may be made by it. Among others may be mentioned the physical constitution of the sun, comets, meteors and star clusters; the velocity of stars in the line of sight; and the absolute proof of the meteoric theory of Saturn's rings, this latter was accomplished by Keeler in 1895, at Allegheny, Pa, in proving that the particles at the outer edge of Saturn's rings were moving more slowly than the inner, which would not be the case if the rings were continuous. The observations at Williams Bay, Wisconsin, with the Yerkes Telescope; those at Mount Hamilton with the Lick Telescope; and those of the new Solar Observatory at Mount Wilson are likely to give the most information in these respects, although a great amount of very valuable work has been done in Germany, France and England. It seems reasonable to expect that most of the brilliant discoveries of the future will be in the fields of photographic and spectrographic astronomy. In the astronomy of double and variable stars

a great amount of work has been done, especially at the Harvard University. Among these variables may be mentioned, stars whose variations are gradual, those that fluctuate irregularly, those that suddenly blaze out and disappear, like the star seen by Tycho Brahe at Copenhagen in 1572, which suddenly appeared almost as bright as Jupiter, increasing in brilliancy until it was brighter than Venus at its greatest brilliancy, and then after about 16 months became invisible to the naked eye, which was the only means at command for observing it as this was before the invention of the telescope. Several stars of this type have appeared within the last 20 years. The one in the great Nebula of Andromeda in 1885; the one in Anriga in 1892, and the one in Perseus in 1901, are probably some of the most remarkable. There are other varieties of variables known as long period variables, and short period variables. The one having the shortest period known at present was discovered by H. M. Paul at the U. S. Naval Observatory, on April 13, 1888, and announced in the Astronomical Journal on March 28, 1890. It goes through its period in 7 hours, 46 minutes and 48 seconds, and only varies by about half a magnitude. Other variables, like Algol remain bright most of the time, and then apparently become suddenly eclipsed as though occulted by some unseen star revolving around it. That this is the true explanation was proved spectroscopically by Vogel at Potsdam in 1889, and in observations on Algol and the period of revolution of the two stars and their masses were determined, an illustration of the fact that the orbit of a double star had been practically computed before any one had even seen it. The existence of a companion star was proven in the case of Sirius before the invention of the spectroscope. It was observed that there were small deviations from the computed place of Sirius and these small oscillations and perturbations enabled astronomers to compute the position and orbit of the disturbing body. This small disturbing body was seen by Alvan Clark in 1865, but the evidence of its existence was complete before its visual discovery.

The problems of the material universe are so vast that we can only expect to get a glimpse of them and there are no doubt numbers of them that will ever remain unsolved. The composition and shape of Nebulæ and star clusters, the parallaxes and distances of the stars the motion of the Solar System in space, the composition of the sun and the proper motion of the stars are all problems of great interest.

In the domain of Theoretical Astronomy, it is interesting to know that the United States has contributed her full quota. During the last half century the books prepared by Professor Brünnow, at Ann Arbor, and Professor Chauvenet, at Annapolis on Spherical Astronomy are probably equal to any books published on that subject; that of Professor Watson, at Ann Arbor, on Theoretical Astronomy ranks very

high as a text book on that particular subject; the works of G. W. Hill on Celestial Mechanics are acknowledged by the most competent experts to be equal to the very best; and the latest book of Professor Newcomb on Spherical Astronomy is a very valuable work, while the popular works on Astronomy by Newcomb and the series of books on that subject by Professor Young, of Princeton, are up to date and all that can be desired as a popular presentation of the subject.

RESUMÉ OF RESEARCHES IN THE HIGHER METEOROLOGY.

By Frank H. Bigelow, L.H.D., Professor of Astro-Physics.

Preliminary Remarks.

The writer of this paper has been working for a number of years under the auspices of the U. S. Weather Bureau, to throw light upon the relations between the amount of the variable energy emitted by the sun and the corresponding changes in the circulation of the earth's atmosphere. This complex problem has been the subject of scientific research for a century, but it is only within the past fifteen years that important progress has been made. The first set of observations that attracted attention to the variability of the sun was the periodic change in the number of the sun spots; corresponding with that there is a synchronous variation in the frequency of the number of the auroras, and in the intensity of the magnetic field. There had been some efforts made to trace out the corresponding variations in the meteorological elements, namely, the pressures, the temperatures, the precipitation and the storm intensity in various regions of the earth, but on the whole the synchronism was not very satisfactorily exhibited. There were numerous symptoms of such a connection between solar activity and the climatic or weather conditions on the earth, but the solution hardly reached the required grade of scientific precision required to carry conviction to the minds of students generally. That there was a problem worthy of attack was probable, and yet the discouraging features were such that it required considerable determination to deliberately take up the work. The unusual complexity of the interrelated sciences, and the enormous masses of data that required to be discussed were the principal objects of difficulty to be overcome.

The writer's previous training had, in some degree, adapted him to take up this special research, and it may be worth while to make a record of those circumstances. Five years of work with Dr. B. A. Gould in the Cordoba Observatory, Argentine Republic, had acquainted him with the best methods of treating great quantities of astronomical data with the view of rendering the individual observations homogeneous; three years of experience in the Naval Observatory and Nautical Almanac with Professor Simon Newcomb on his planetory tables had developed the practise of long and intricate computations; six years as Professor of Mathematics in Racine College had given some facility in the use of mathematical analysis. The coming thus equipped to the study of meteorology gave some advantages over those who had been trained in the prevailing

theories, by reason of being able to examine them more impartially than might otherwise have been possible. Dr. Gould often stated that he believed that solar variability could be matched by the climatic conditions on the pampas of Argentina, and it has since been proven that this is the case, inasmuch as that region with its equable weather is peculiarly fitted to register the incoming solar energy, quite undisturbed by the cyclonic circulations prevailing so vigorously in other districts, as the United States. The interest thus early aroused in this problem gradually changed my astronomical activity to solar physics, and to an examination of the synchronisms to be detected on the sun and on the earth. In spite of the discouragements attending such a massive research as this has been, the absorbing character of the problems, and the hope of establishing a valuable practical process of long range forecasting has been an unfailing incentive to persevere. The general features of the research may be summarized under three heads, namely:

I. The solar-terrestrial electric and magnetic fields.

II. The circulations of the atmospheres of the sun and of the earth respectively, and their mutual relations.

III. The reconstruction of the observational data.

The first involves questions in solar physics as to the electrical and magnetic conditions in the solar and terrestrial envelopes, and their physical connections by external magnetic fields and by radiation energy; the second comprised a series of problems in the thermodynamics and hydrodynamics of the two atmospheres respectively, the general circulation, and the secondary circulations in local cyclones and anticyclones; and the third implies the recomputation of the long series of observations on the sun for the spots, prominences and faculae; and on the earth for the temperatures, pressures and vapor tensions, which must be reduced to homogeneous systems. The rapid accumulation of observations of all sorts, in many cases without systematic discussion, the remarkable improvement in instruments of precision, and the numerous scientific papers coming from the press make it very difficult to keep in touch with all branches of the subject of cosmical meteorology. Indeed, the growing recognition of the value of these topics is to be noted in the organization of numerous societies, international and local, to discuss the details and subdivide the work; in the foundation of new observatories, Mt. Wilson, Pilar, Tortosa, Mt. Weather; the increased activity at the older institutions, Yerkes, Smithsonian, South Kensington, Meudon, Potsdam, Zürich and Catania; and in the greater number of scientific researches and papers planned to elucidate the several features of the general problem. We may now pass to some details to explain these preliminary remarks.

I. *The electric and magnetic fields of the Sun and the Earth*.—One of the important subjects of debate in science is the magnetic state of the sun. Opinion has fluctuated for and against the sun being a highly magnetic sphere, as it were in response to the ebb and flow of the tide of the

advancement of the science of electricity and magnetism. There have been three strong arguments urged against the probability of the sun being a large rotating magnet, somewhat like the earth with which we are familiar, carrying with it an external magnetic field of force. The first is that the intense heat of the sun is fatal to its mass being magnetized, the second is that the great magnetic storms felt on the earth would require so great a change in the sun's normal potential to emit the required energy as to be prohibitive; and the third is the difficulty of accounting for the variable magnetic field at the earth in synchronism with the period of the solar rotation, which implies that the structure of the sun is not homogenous in longitude so far as radiation is concerned.

The Sun's heated mass, magnetized or not.—The answers to all these questions really depend upon the exact constitution of matter itself, and until our knowledge of that is complete we must be content with more or less speculative hypotheses. During the years when the argument seemed to be against the sun as a magnetic sphere, the original form of the kinetic theory of gases held sway. On this view matter consisted of highly elastic, smooth spheres of small dimensions, undergoing collisions of a high order of number per second, and under this conception there is certainly no easy path to the theory that the sun as a mass of highly heated gas is also magnetic. It seemed worth while, however, to accumulate the available circumstantial evidence in favor of the magnetic sphere hypothesis, while waiting for the complete explanation. Primarily, the fact that the *earth while very hot in its interior yet sustains a magnetic field dependent upon internal magnetization*, seems to require the admission that in some way the sun and all hot rotating celestial bodies may likewise be magnetized spheres. It is proper to look to the prevailing theory of matter as the real topic of investigation. This general point of view is greatly strengthened by the physical aspect of the sun itself. Improvement in the photography of coronas during the successive solar eclipses shows that in the years of minimum activity the rays of the corona take on forms exceedingly like the field of a magnetic sphere. The equation of the lines of force seems to be equally applicable to both objects. Pursuing the subject further and regarding the rays seen on the photograph as the traces in projection of the rays springing from the sun in three dimensions, it was found that the bases of these rays tend to concentrate in a ruffle surrounding two poles, or centers of coronal divergence. An experiment on the electrostatic lines of a sphere in a magnetic field shows that the *visible* rays recede from the poles, and accumulate in maximum rings like the auroras on the earth. Noting carefully the angular position of these coronal poles from one eclipse to another, it was found that the poles do not lie on a diameter but are somewhat asymmetrically displaced, and that the successive positions can be matched by turning a model of the solar corona around in a period of rotation assumed to be that of the sun itself at the equator. If solar action at the photosphere produces very light materials

which are ejected by repulsive forces, such as electric repulsion, or the mechanical pressure of light, and this system is located on a magnetized sphere, then the effect is just what one would expect to find in the external coronas.

The recent developments of researches into the constitution of matter have resulted in showing that probably the atom is a highly complex dynamic and electrical structure, composed of rotating ions under mutual attractions. If matter consists ultimately of moving charges of electricity, then it is evident that all matter sustains complex magnetic fields depending upon the movements of these structural electric charges. External fields depending upon internal magnetization imply that the internal motions of the electricity are polarized, and that the electric currents on the average are parallel to a given plane. An increase in heat may destroy the field of a steel magnet by disorganizing the impressed polarization, but it does not destroy the possibility of magnetization if there is any force sufficient to produce polarization at the same time. It is well known that the rotation of a celestial body on its axis produces such a force acting at right angles to the path of a body in relative motion. This may be the primary cause of the observed polarization of the sun's material as shown in the external rays of the coronas. The Zeeman effect indicates that all matter emitting light is magnetic; the study of the series of lines in the spectrum, the shifting of the lines under pressure and the attendant phenomena, seem to be best explained on the hypothesis of rotating atoms and ions carrying electric charges with them. I am, therefore, of opinion that the theory that the sun is a highly magnetic sphere has gained considerable strength within a few years, and that the subject, though complex, is worth further research.

The energy of great magnetic storms.—Lord Kelvin's evaluation of the energy formula,

$$E = -\frac{1}{8\pi} \iint V \frac{dV}{dn} \, dS,$$

for the variation in the earth's magnetic field during a great storm shows that the corresponding change in the sun's potential V is too great to be permissible. His inference that the supposed connection is unreal implies that the energy of the solar storm depends solely upon the variation of the potential, but this may by no means be the fact. Indeed, there are two lines of argument which indicate that this source of energy is only a part of the supply available to affect the terrestrial magnetic field. (1) The sun as a magnet acts through its external field upon the earth; (2) the radiation field of the sun is now believed to be variable in its intensity in solar longitude, so that during a rotation of the sun it acts more or less intensely upon the earth's atmosphere; (3) the ionization products in the atmosphere of the earth, depending upon solar radiation, have circuits of their own which may properly affect the earth's field temporarily, after

receiving a comparatively small impulse to start them, sent from the sun. The complexity of this physical problem is, therefore, by no means exhausted by the potential theory.

More specifically, on compiling the data of the earth's magnetic field in the period of the sun's equatorial rotation, which may be assumed to be that of an internal nucleus from which the external outgoing energy is ultimately derived, it was found that a certain typical curve of magnetic variation was obtained having these characteristics; there are two principle maxima, on opposite sides of the sun, and there is a series of minor crests superposed upon this primary curve, showing that for some reason the solar output is not uniform in longitude. Similar compilations for the sunspots and prominences match this curve with some degree of precision on the sun; extensive discussions of the terrestrial temperatures, pressures and vapor contents of the atmosphere also give the same curve for the earth. These conditions are so various, and the fundamental impulse so persistent in the solar elements, the earth's magnetic field and its meteorological elements, as to render it evident that one common expenditure of solar energy is really responsible for them all. These results have been published at intervals since 1893, when the first preliminary examination had been made. In 1905 Mr. Maunder showed from his study of the large magnetic disturbances by themselves that they tend to concentrate on opposite sides of the sun, thus confirming my earlier conclusion. A careful discussion of the temperatures of the lower strata of the atmosphere, as derived from the balloon and kite ascensions in Europe and North America, shows that the temperature curves near the surface of the ground change their character in the free air, in such a way as to afford a simple basis for an explanation of the variation of the magnetic field by movements of the ions in streams as controlled by these temperature waves. This makes the line of cause and effect quite intelligible: (1) variable radiation in solar longitude, depending upon the structure of the solar mass, (2) variable ionization and temperature effects in the earth's atmosphere, (3) sychronous variable magnetic field, and circulation of the earth's atmosphere, giving local changes in pressure, temperature, rainfall and climate. The details of computing the observations which lead to these conclusions are very extensive, and they have been published only as brief summaries or extracts. They include a careful compilation of the strength of the magnetic field from day to day, 1841-1905, in diagrams and tables; (2) a complete compilation of the solar prominence observations, 1872-1905; (3) a complete rediscussion of all the pressure, temperature and vapor tension observations, more than 200 stations for the United States, 1871-1905; (4) miscellaneous discussions of the meteorological elements in all portions of the earth, the magnetic field at 30 stations for the diurnal period, the ionization phenomena, the auroras; and on the sun, the spots, faculae and prominences. Could this material be published, it would form the basis of the proper study of this solar-terrestrial problem

in cosmical meteorology. The recent and more refined tabulations, 1872-1905, for the prominences, magnetic field and temperatures of the United States are decisive so far as the *annual* synchronism is concerned, and we are now trying to extend the discussion from the annual to the monthly variations in the United States, with the hope of establishing the possibility of so-called long range or seasonal forecasts of the weather conditions. The problem fifteen years ago was generally considered to be merely interesting as a speculative scheme; today it has passed out of that stage of development into a state where work and skilful discussion of the data give us promise of an ultimate success on a strictly scientific basis. The demand for trained students capable of treating the numerous problems in physics, astrophysics and meteorology arising from these observations, is such that provision must be made in the universities for educating this class of investigators.

II. *The circulation of the atmospheres of the sun and of the earth, respectively, and their mutual relations.*

1. *The circulation of the solar mass.*—The problem of the circulation of the mass of the sun is difficult to solve because of the necessity of passing by inference from observed surface conditions to those corresponding with them in the interior. The Italian spectroscopical observations, 1872-1905, have proved to be very valuable in giving a fair idea of the distribution of the prominences and faculae in different latitudes, from which rotation periods in longitude can be approximately computed from the equator to the poles, 26.68 days at the equator and 29.50 days near the poles. The movement of the sun spots in longitude and latitude has been carefully studied by several investigators. The variable frequency of these objects and their movements show that the solar mass is in constant circulation, in a rough periodic fashion, of which the 11-year period is best known. Schuster has recently analyzed the general curve into elements $\frac{1}{3}\times 33.375 = 11.125$, $\frac{1}{4}\times 375 = 8.344$, and $\frac{1}{7}\times 33.375 = 4.765$. The short period found by me in the terrestrial elements, 2.750 years, is distinctly shown in the solar prominences and sun spots. Now, the primary perplexity in trying to apply thermodynamic relations to the solar mass is the inability to assign the proper value to $k = \frac{Cp}{Cu}$, the ratio of the specific heats. In the earth's atmosphere this value is 1.41, but on the sun it may range from 1.66 if the material is strictly monatomic to 1.10 if the molecules are of highly composite structures. The former hypothesis leads to such enormous pressures and temperatures, using the adiabatic law, as to be incredible; the latter is satisfied with very moderate pressures and temperatures, say surface temperature just within the photosphere 7.500 degrees and near the center 10.000 degrees, with corresponding pressures and densities. We may discuss the subject from the view of dissociation of the atoms under high temperature, as is likely to be the fact in the solar atmosphere where the pressure is removed and the spectroscopic lines

are formed; or we may lay the emphasis upon the balancing of the internal pressure and temperature so that there is formed a quasi-solid nucleus. The leisurely circulation apparent at the surface of the sun certainly suggests a slowly moving, highly viscous condition near the center, and this seems to be most in harmony with the facts. But this transition from k=1.66 near the surface to k=1.10 in the interior implies a change in the structure of matter itself, which, indeed, in solar physics may actually be the case. We need especially to find some clue to the function controlling these values of k.

To assume certain surface temperatures and a given k, and then by the adiabatic formalae to compute corresponding internal values is of course merely a numerical process, in the present stage of science, and probably not very valuable, though testative discussions are of course necessary. Allowing that k is not known, we may yet form some idea of the sun's interior circulation by resorting to the general equations of motion, and finding the relation between temperature and velocity using those values of the pressure determined by the assumed k. Helmholtz and Emden have discussed this subject for the sun, with the general result that the sun is a huge vortex, whose axis is parallel to the axis of rotation. The period decreases from the equator to the poles, and the temperature increases from the equator to the poles. The several elements of the vortex produce discontinuous surfaces, or layers of different temperatures sliding past one another, in such a way that the vortex filiments rotate in the right handed sense looking from the equator to the North pole. In case the solar mass consists of elementary electric charges this structure is favorable to producing the magnetization mentioned above as probably prevailing in the solar mass. If we admit this circulation and variability in the periodicity, then the entire mass of the sun should pulsate, and even change its shape, as shown by the relative length of the polar and equatorial diameters. Poor's examination of the Rutherford photographs, 1860-1874, some German Heliometer measures, 1873-1875, and 1880-1883, and 1890-1902, bears upon this interesting question. The result of the discussion as reported is that the equatorial diameter is longer than the polar at the time of the sun spot maximum, and shorter in the sun spot minimum. A comparison of the details of the variability in Poor's paper with the periodic variability or rotation given in my paper on the circulation of the sun's atmosphere, Monthly Weather Review, October, 1903, shows that the same synchronism exists between diameter and rotation. The period of rotation is lengthened in the polar region as the polar diameter is shortened, and in some way the bulging of the equatorial zone is accompanied by a slowing down of the periodic rotation in the polar zones. The difficulty of handling the observations correctly is such as to produce matters for discussion, but it seems to me that this result is in agreement with the structural vortex required by the general equation

of motion. The entire subject constitutes one of the fascinating, yet difficult problems of research in solar physics.

2. *The general circulation of the earth's atmosphere.*—The theoretical connection between the circulation of the solar mass, and that of the earth's atmosphere is not so remote as might be supposed. In the case of the earth its atmosphere is subject to two principal motions, an eastward drift in the temperate zones with the velocity increasing upwards from the surface, and a relative increase upwards of the temperature; also a westward drift in the tropics with a decrease of the velocity upwards and a relatively rapid decrease of the temperature upwards. Thus, on a non-rotating earth the temperature gradient might be at some given normal value for each latitude, depending upon the conduction and convection of heat in a vertical direction. With a rotating earth this temperature gradient is diminished in the temperate zones, but increased in the tropical zones, and this conforms to our observations. Now, the general equation used for the sun has three cases for its solution, and two of these cases apply to the earth's atmosphere as just described. The presence of the land and water areas tend to produce local modifications on a large scale, so that the practical application of the equation is not readily executed. Indeed, we shall have to wait for suitable observations in the higher levels of the atmosphere by means of balloons and kites before the solution can be completed. The temperatures in the north temperate zone have been fairly well explored by the work done at Berlin, Hald, Trappes and other stations in Europe, and at Blue Hill in the United States. Results are being reported from the ocean areas by Hergesell, Teisserenc de Bort, Rotch, Clayton, Fassig and Bigelow, extending into the tropics. No high altitude records have been made in the Southern Hemisphere, but Mr. Davis is planning such a campaign in the Argentine Republic. The scheme of circulation here mentioned differs radically from that proposed by Ferrel, and elaborated by Oberbeck. Their canal theory taught that the warm air of the tropics rises from the surface, spreads towards the poles, descends in high latitudes and returns to the tropics near the surface. This is only true in part. My theory shows that this single circuit is broken up into three circuits, one in the tropics, anticlockwise in the Northern hemisphere for an observer looking eastward; the second in the temperate zone and circulating clockwise; and the third in the polar zone being anticlockwise in its direction. A portion of the heated air of the tropics escapes poleward in the high levels, and a portion leaks out poleward in the lower levels. In the temperate zone there are counter currents near the surface and up to five or six miles high, consisting of northwest winds bearing cold air, and southwest winds carrying warm, moist air. In the tropics the northeast trade winds near the surface reverse into southwest return trades in the higher levels, though they do not extend beyond the tropic zone. The northwest winds of the temperate zone in the higher levels overspread the tropic zone to some extent, and tend to

mix with the warm air from the equatorial belt. These are thus two great mixing regions, one near the surface, 0 to 3,000 meters, and the other in the high levels, 10,000 to 14,000 meters, but between them the eastward drift is not much disturbed by air transported into it from the tropics on those intermediate levels. The high pressure belt near latitude 33° at the surface spans the tropics in a lofty arch, six miles high over the equator, and this separates the eastward from the westward drift. This belt, instead of being continuous around the earth, as theory suggests, is broken up into great anticyclonic centers of action, in summer central over the ocean areas, in winter central over the continental masses, according to the prevailing surface temperatures. Hence, in summer over the Atlantic ocean in the northern hemisphere, southwest winds prevail on the North American side bringing the moist warm air that characterizes the summer season in the United States; on the other hand, northwest winds prevail on the European side, and the summer weather is in consequence dryer and generally cooler. This causes the trend of travel from America to Europe in the warm months of the year. In the winter a cold high area settles over North America and another over Europe and Asia. The prevailing eastward circulation brings this high area with its cold to the south and eastward in America, with cold waves and severe weather; while in Europe the outflow of cold from the Asiatic high area is retarded by the same eastward drift, and Europe is protected partially from the severe cold weather which prevails in Siberia and is proper for that high latitude. Thus, Europe is cooler in summer and warmer in winter, than the United States, strictly in accordance with the meteorological processes of the general circulation. The influence of the waters of the Gulf Stream upon European weather is insignificant in comparison with these effects of the atmospheric currents. At present the facts regarding the general circulation are attracting wide attention and vigorous research, observations are being made in increasing numbers yearly, and students equipped with hydrodynamics and thermodynamics are needed to carry on this work.

3. *The local circulation in the earth's atmosphere.*—The theoretical development of the causes that produce and sustain the circulation in storms, the cyclones and the anticyclones of the temperate zones, has been singularly unsuccessful, considering the amount of study that has been bestowed upon this subject. The trouble has arisen from the early introduction of several incorrect general theories, which have continued in the literature of meteorology with unusual persistency. In consequence of the fact that the barometric pressures of cyclones and anticyclones on the sea level plane are arranged more or less symmetrically about a central axis, it was perhaps not unnatural to assume that warm-centered or cold-centered temperatures should likewise to be symmetrically distributed about the same center. Consequently central vortices only have been studied, and a persistent effort has been made to account for the forces required to derive

these circulating structures, namely a column of air ascending rapidly in the central regions of the cyclone, but descending in the anticyclone. The favorite physical cause of such a column of buoyant air has been the latent heat derived from the condensation of vapor into water, as proposed long ago by Espy and advocated by Ferrel, Abbe and others. A brief examination of the synoptic charts show that these ideas cannot be correct even in their broad features: (1) The warm areas are not distributed symmetrically about the central axis in cyclones, at least on the surface charts, but rather the warm area lies between the center of the cyclone and the anticyclone on one side, while the cold area lies between the anticyclone and the cyclone on the other side. In a word, storms are relatively warm in the eastern quadrants in the United States, and cold in the western quadrants, and the minimum of cold and the maximum of warm air, respectively, are on the borders of the cyclones and the anticyclones instead of at their centers. (2) The second difficulty with the latent heat theory is that many storms occur in a highly developed state without any rainfall, and many large rain areas do not develope any cyclonic circulation. Now, there may have been some room for discussion while the temperature observations were confined to the surface, but with the accumulation of the upper air observations by balloons and kites, it has been made plain in my papers that the same asymmetric distribution of temperature persists from the surface at least to the height of five or six miles. This fact, therefore, changes the entire trend of meteorological literature, and while there exists vertical convection in the cyclone, it is really the horizontal convection that is chiefly responsible for the energy in storms. Ferrel proposed one type of central vortex which is inadequate to the case, and German meteorologists have developed another type of central vortex, likewise defective when applied to these phenomena of the circulation. In my researches the following steps have been developed in the attempt to build up a new theory of storms. In the international campaign of 1896-97 for the measurement of the velocities of the upper strata of the atmosphere by cloud observations, the form of the circulation in the several 1,000-meter levels has been thoroughly mapped out; in the discussion of the barometric pressures of the United States and Canada, the pressure distribution at three levels, sea-level, 3,500-foot, 10,000-foot, have been carefully discussed; and in my recent papers on the Thermodynamics of the atmosphere the temperatures in the upper levels as observed in Europe and North America have been worked up. These three systems are now in harmony, and form a most interesting problem for mathematical development.

It was shown above, in the section on the general circulation, that in the restoration to normal temperature equilibrium there are warm currents from the tropics which meet cold currents from the polar zones, and that these counter currents flow together in the temperate zones. Their mutual interaction produces the observed cyclones and anticyclones,

chiefly by the operation of horizontal connection between air masses of different temperatures. The details of this computation are too extensive to be reproduced in this paper, but, in a word, we deal simply with those gradients of pressure and temperature, which result in just such circulations as are found to eist. The point of view is, therefore, radically changed, from (1) a supposed central symmetrical column of warm or cold air, respectively, giving rise to vertical convection; to (2) horizontal convection between two masses of cold and warm air asymmetrically disposed to the centers of gyration. The far-reaching character of this idea, in its application to local circulations can readily be seen. When two masses of air of different temperatures flow together under the impulses of the general circulation, they primarily set up cyclones and anticyclones, as the dynamic effects of the thermodynamic causes. Similarly, the cloud observations in the West Indies show that hurricanes are generated in the higher strata of the air when two currents of different temperatures flow together, the great tube penetrating to the surface by strictly vortex motion. Our study of the great water spout at Cottage City, Mass., shows that two masses of air of very different temperatures were operating upon each other on that occasion in the cumulas cloud levels, so that tornadoes and water spouts have exactly the same origin as hurricanes, the former being vortex tubes one mile high, and the latter as much as six miles high. The vigor of these vortices depends upon the contrast in the temperature, say 20 to 30° Fahrenheit. The hail accompanying a tornado is found to be the result of snow nuclei falling through the series of ragged stratifications where the warm and cold air mutually interpenetrate in a vertical direction. Thunder storms are likewise the products of the interaction of such warm and cold masses as arise in the course of local superheating of the surface layers in warm weather, this being really a case of vertical more than horizontal convection. It is, thus, impressive to see in the atmosphere one simple principle dominating its circulation—(1) the heated air of the tropics and the cold air of the polar zones counter-flowing and interpenetrating to form the general circulation; (2) the smaller currents of warm and cold air counter-flowing in the lower levels to form the cyclones and anticyclones of the temperate zones; (3) the still smaller masses of warm and cold air counter-flowing in the high levels of the tropics to form the hurricanes, and in the low levels of the temperate zone to generate tornadoes and water spouts; and (4) the still more contracted operation of these forces in thunder storms, and the numerous minor whirls observed in the atmosphere. This sub-division of thermodynamic energy goes on to yet smaller dimensions and forms an important element in the internal dynamic friction, which retards the rapid onward flow of the currents of air. These dynamic motions from large to small are the sufficient sources of the retardation by which the atmosphere is kept flowing at comparatively moderate velocities instead of at such high velocities as to be continuously destructive. Thus, in the temperate zones a few miles high,

winds of 90 to 120 miles per hour are always prevailing, while at the surface the wind is usually 10 or 15 miles per hour and even less than that. The numerous problems arising in the thermodynamics and hydrodynamics of the atmosphere are evidently such as to call out the energy of able students, who require special training to make progress in such researches. There is really no field of modern science that is so well fitted to repay the labors of investigators as that opened up by the observations of the upper atmosphere, now being made accessible by balloon and kite ascensions. The entrance into meteorology of advanced students in physics and astrophysics is one of the most encouraging signs of the times. The field is, however, so very large that close specialization is now required to develope the various branches of the subject.

III. *The reconstruction of the observational data.*—Meteorological observatories in most instances have been more dependent upon the exigences of the local services than upon the ultimate demands of rigorous science, and the result has been that they are not usually homogenous for a long series of years. The local offices have been changed, the instrumental conditions have varied, but especially the methods of computing the observations have not been satisfactory. The demands for increased efficiency in meteorology, such as an improvement in forecasting, and applications in solar-terrestrial meteorology, have made it important that the original records should be made homogenous and reduced to standard conditions. For this purpose the entire system of the barometry of the United States and Canada has been rediscussed for the years 1873 to date, the corrections for altitude, gravity, instruments, hours of observations have been applied, the discussion of the temperature gradients on the plateau and in the low level districts give the required temperature arguments, and finally, reduction tables to the sea-level, the 3,500-foot and the 10,000-foot planes have been prepared for all the stations. We have made for a year, 1903, daily weather maps of pressure on these planes, and they have proved to be very instructive in studying the theory of storms outlined above. An extensive report has been prepared on the subject, and it is evident that similar high level auxiliary maps will be employed in forecasting not only in the United States, but in Europe and South America, where regular forecasting services are established. Similar recomputations of the temperatures and vapor tensions for the United States are in progress, for the purpose of securing normals depending on 33 years of observations, 1873-1905, for forecasting and climatological work, and for the development of cosmical meteorology by comparing the annual and monthly variations with the relative frequency of the sun spots, the faculae and the prominences. It can be stated that from a preliminary comparison with this excellent temperature data, there is a continuous synchronism in the *annual* variations of the solar prominences, the terrestrial magnetic field and the temperatures and pressures of the United States. That fact may be considered as fully established, and it shows that the solar energy registers itself synchron-

ously in these three types of phenomena, so that a fundamental function really exists between them, if it can be fully worked out. In the comparison for the *monthly* synchronism the harmony is less persistent, but it evidently takes effect between the prominences and the temperature up to 75 or 80 per cent of the maxima and minima. The massive amount of this material required much work in its construction, but there is promise of a good practical result when this data can be suitably studied and digested. It may be said that this is the first reliable data that can properly be used in any definite solar-terrestrial studies, aside from those of a distinctly preliminary kind, necessary in testing the possible promising lines of development. At present the great demand is for liberal printing of this revised data, since it summarizes the work of the American Meteorology for the first third of the century of its existence. Without it our work is relegated to the vaults, and but very little of it can reach other scientists and the public.

PATHOLOGICAL REPORT AND HISTOLOGICAL STUDY OF AN ENDOTHELIOMA OF THE CEREBELLUM, WITH SOME GENERAL REMARKS ON THE FUNCTIONAL DIFFERENCES BETWEEN THE CELLS OF ENDOTHELIUM AND OF EPITHELIUM.

By James Carroll, M.D., Professor of Bacteriology and Pathology.

The following amplification of a report of the pathological examination of a tumor of the cerebellum was written about nine years ago, but its publication has been delayed by the work incident to the breaking out of the Spanish-American War, the pursuit of investigations into the etiology of yellow fever, and the desire to include additional cases of endotheliomata, as well as to discuss at greater length the general subject of the functions of the cells of endothelium as compared with those of epithelium. While many other endothelial new growths have been encountered, the time necessary for detailed histological investigation has been lacking; nevertheless this single unique tumor belongs to a group of such great interest and importance that it deserves the most careful consideration and study.

The case was originally reported by Professor E. L. Tompkins of Columbian (now George Washington) University, in the Virginia Medical Semi-Monthly for February 12th, 1897, and from this the clinical history is taken. Those who are interested in the gross and microscopical characters of this tumor are referred to the photograph and photo-micrographs published with Dr. Tompkins' clinical report, which includes three cases.

> Clinical History. "Case III. James L. aet. 16, white, came to my clinic at the Emergency Hospital on December 6, 1894. His history was as follows: About two and one-half years ago, he had typhoid fever, but had never had any convulsions. Soon after, he began to have severe pain in the back of his head and vomiting. About two months before he came to me, his mother noticed a change in his voice, and that he tottered in his gait. Now he has headache all over his head, but only at times; it aches worse after getting up from the recumbent position.
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> On examination, I found that his head was rather large, eyes very prominent, and nystagmus well marked. He reeled in walking, always to the right; was unable to walk a straight line and had to be supported on either side. Both knee

jerks exaggerated; ankle clonus well marked in left leg, only partially so in right; but right leg appeared to be weaker than left. Choked discs of both eyes, but does not complain of loss of vision. Mental and muscular movements apparently rather slow. He walked with legs apart, and with much inco-ordination. His mother had been told that he had 'spinal disease' by several physicians.

I at once thought that he had a tumor of the cerebellum, and put him on increasing doses of iodide of potassium.. He came to the clinic for about a year, sometimes feeling better, at other times worse; and finally I lost sight of him, until August 31, 1896, when I was sent for and found him practically dying, having not seen him for about a year.

I made the *post-mortem* examination, and found the tumor which I now present to you. The tumor lies imbedded in the under and anterior portion of the right hemisphere, encroaching decidedly over the median line and pressing on the medulla.

Another interesting feature was the very large quantity of cerebro-spinal fluid that escaped as soon as the dura was opened, there being at least a quart that came in a perfect gush."

Anatomical Diagnosis.—*Endothelioma of the dura mater, growing into the right cerebellar hemisphere from below in such a manner as to form an excavation in which the tumor rests, the pia mater and arachnoid being carried before it.*

The tumor is about as large as a small orange, and is shaped like a strawberry, its base being external and the blunt flattened apex completely hidden within the cavity in the cerebellum. Besides entering and compressing the lobe of the cerebellum on its own side, it has also displaced the medulla, pons, and other important tissues towards the opposite side. The tumor can be easily shelled out of its bed, and the surface in contact with the cerebellum is then seen to be marked by numerous shallow depressions or sulci where the pia with its vessels has been removed. These vein-like sulci mark the positions occupied by the vessels carried in the membrane. Upon partially withdrawing the tumor from its cavity its surface is found to be covered by the vascular pia mater, while the base or pedicle is slightly roughened at the site of its attachment to the dura mater, which is reported to have been easily stripped off. This can be explained by stating that the growth contains but little fibrous tissue, and consists solely of columns of large epithelial-like cells, supported by a very delicate stroma carrying thin-walled blood vessels.

The vascular pial membrane covered the entire surface of the growth wherever it came in contact with the cerebellum, was carried

into the cavity before the tumor, and reflected thence to its normal position upon the surface of the organ. The membrane retained its normal relation to the cerebellum as long as the tumor remained undisturbed. The mesial border of the tumor has not been disturbed, and shows the intact membranes, vessels, and nerves, holding the mass quite firmly in position. Its thickened ventral margin is broken by a rather large gap, made by the removal of several pieces of the tissue for histological purposes before the photograph was taken. The lateral expansion and thinning of the cerebellar hemisphere by pressure are well shown, and so is the lateral displacement of the pons and medulla. The tumor entered the right hemisphere of the cerebellum from below and in front, its apex being directed backward and slightly upward.

The histological picture presented by this neoplasm is that of an abnormal and exaggerated reproduction of the perivascular lymphatics, surrounding and supported by a relatively insignificant number of delicate blood vessels; the most striking feature being a remarkably free and luxuriant growth of the endothelium lining these lymph vessels. The endothelial cells referred to present all gradations in form and type from the low, flat, almost squamous cell, through the cuboidal and low columnar to high columnar forms, which exactly resemble the reproduction of glandular epithelium in some carcinomata. In places there appears a tendency toward a stratified and even alveolar arrangement, but this is rare. The prevailing types are large, cuboidal, or columnar cells arranged to form tubular spaces, and close inspection will disclose that these tubules, so to speak, bear a definite and constant relation to the thin-walled blood vessels, i. e., they are arranged systematically about them and tend to run in the same general direction. The vessels are central, and the gland-like spaces are peripheral, the axis of the lumen of the vessel running in the same general direction as those of the more or less enlarged lymph channels surrounding it. There is a remarkable absence of stroma of any kind; the adventitia of the vessels serves as a sort of basement membrane supporting the endothelial cells of which the bulk of the growth consists. The beautiful tubular arrangement of the structure, with its large juicy cells and brightly staining nuclei, suggested at the first glance adenocarcinoma, but the normal dura mater contains no epithelial cells from which such a structure could originate, while that membrane is particularly rich in lymphatics. The contents of these newly-formed and often dilated lymph spaces in the specimen proved of considerable interest, and determined the character of the new formation. There were numbers of small lymphoid cells (the normal lymph corpuscles) with a limited amount of protoplasm and round, deeply staining nuclei; other forms with larger nuclei and relatively more protoplasm; others again were large polygonal cells

with pale protoplasm and oval or indented nuclei. Here, in the last mentioned form, was a cell that could not be differentiated from the transitional leucocyte of Ehrlich, which according to recent investigators originates from endothelium. In addition to this all intermediate forms beween it and the small, mononuclear lymphoid cell with deeply staining nucleus, could be found, including the larger lymphoid cell and the large mononuclear, the latter with a relatively considerable amount of protoplasm. This would seem to be in confirmation of Ehrlich's teaching that these forms all represent different stages in the development of the same cell. Small forms with indented nuclei were also observed, and some of the spaces contained cells that were at first supposed to be polymorphonuclear leucocytes, but which were later regarded as hyaline and lymphoid cells with rapidly proliferating nuclei, for the reason that these nuclei were almost always double, very rarely triple, and seldom or never irregular like those of the typical polymorphonuclear leucocytes. They also stained with less intensity.

It was extremely interesting to observe that these small lymphoid cells, with single or double nuclei staining brightly with hæmatoxylin, were found, not only in the dilated tubular spaces in considerable numbers, but also throughout the solid portions of the growth, where they were packed in between the larger cells with vesicular nuclei. All intermediate forms between these and the large, hyper-developed, endothelial cells could be found with ease in various parts of the section and all varieties of these cells were found here and there in stages of active proliferation, having double, multiple or budding nuclei. These appearances justified the conclusion that all of the cells described were proliferated from the endothelium. No red blood cells were found within any of the tubular spaces.

The presence of cells indistinguishable from large and small lymphocytes and large and small transitional forms, in this structure, pointed strongly to endothelium as the progenitor, in part at least, of these varieties of leucocytes, the more so since the hyaline forms are said to occur in large numbers in the fluid in the cerebro-spinal and serous cavities, which are lined with endothelium. This is also another point in favor of the connective tissue origin of the tumor under consideration.

Where the columnar cells were found they were always ranged side by side, and were not detached; this indicates that these forms result, in all probability, from lateral compression.

In addition to the cells above described, many of the spaces contained a structureless, unorganized, finely granular material, the coagulated albumen of the lymph that circulates within them.

Small psammomatous bodies occurred occasionally throughout the section. They were not conspicuous, but were easily found when searched for. This also pointed to the connective tissue origin of the

neoplasm. The tumor was not an infiltrating one; it was malignant only through the pressure resulting from its growth, as would be the case with a simple fibroma of the same size, in the same location.

Perhaps the term Lymphangiosarcoma would be the most accurate one to use in designating the character of this growth, but I have used the simpler one of Endothelioma as indicating more clearly its histogenesis.

The diagnosis was confirmed by Professor Wm. H. Welch, of the Johns Hopkins University, from whose note I quote the following:

> "I would of course call it an endothelioma, but it makes one sympathize with the growing disposition to make no distinction between endothelium and epithelium. It is an exquisite specimen."

The above reference by Professor Welch to the mooted question of distinguishing between endothelium and epithelium, opens up a wide field for discussion in connection with a subject upon which the most eminent authorities hold widely different views at the present moment, and into which I feel hardly qualified to enter. I have noticed, however, that in many of the most recent works on normal histology, the cells lining the blood and lymph vessels, serous cavities, etc., are designated epithelium, the term endothelium being ignored. It seems to me that the view taken by Piersol* is the best one, viz., that the endothelia are modified connective tissue cells, and the fact should not be lost sight of that the cells of epithelium and endothelium, though at times morphologically quite similar, are, in their essential vital properties, widely different. In tissues that are granulating after injury, proliferation of the endothelial cells and the formation of new connective tissue from them can be seen; and, conversely, the connective tissues are seen to develop into endothelium and new blood vessels, showing conclusively that they belong to the same group. On the other hand, epithelial cells are of an entirely different class, being permanently differentiated (in post-embryonic life) into passive, non-amoeboid, non-phagocytic, simple protective, or glandular cells, whose formative powers are of a very low order, in contradistinction to the endothelial cells, which possess reconstructive powers of a very high grade. These are plainly shown in Thoma's description of the organization of vascular thrombi, the result of studies undertaken by Heuking and himself. He there says:

*Normal Histology, Piersol, 1898, pp. 115-116. He states: "The large serous cavities, as the peritoneal or pleural sacs, are in principle but greatly dilated lymph-spaces, lined by modified connective tissue cells, the endothelial plates, which by mutual pressure become polygonal in outline; instead of a few cells sufficing for the formation of a lining membrane as in the case of the minute lymph space, innumerable elements are required to clothe the large serous cavity."

"A better opportunity can hardly be found anywhere for investigating the pathological new formation of connective tissue in its relation to the new formation of capillaries. * * * * Starting from the spot at which the thrombus adheres to the vessel wall, a thin layer of endothelium next spreads over the thrombus. * * * * It soon invests the whole of the thrombus, while underneath it a zone of connective tissue develops. * * * * This formation of connective tissue underneath the endothelial investment of the thrombus appears as the result of the proliferation of this endothelium. The endothelial cells divide, the young newly-formed cells penetrate into the thrombus and secrete an intercellular substance. * * * * At the same time the thrombus mass becomes vascularized from the vasa vasorum on the one hand, and from the endothelial investment on the other. The endothelial investment of the thrombus sends processes downward into the thrombus which become transformed into capillaries. Connective tissue grows round the capillaries in the same manner as under the superficial investment of the thrombus, and forms an adventitia to them. This, however, increases in thickness, while the remains of the thrombus which lie between the newly-formed capillaries disappear, presumably by absorption. The great importance of the discovery consists in the fact that the new connective tissue represents a proliferation of the wall of the vessel, and that there is no transformation of emigrated white blood corpuscles into connective tissue, as was previously believed on the strength of Ziegler's researches."

Could one desire more conclusive evidence than this in support of the statement that simple squamous vascular endothelium can by its proliferation become transformed into new blood vessels and connective tissue? This is a property that epithelium never possesses after its primary differentiation in the embryo.

Such hard facts as these are difficult to reconcile with the classification of some anatomists and histologists (there are a few exceptions) who regard epithelium and endothelium as the same, evidently judging by the microscopical appearances of the cells alone, without regard to their special functions and vital properties.

In this connection I cite as a single example the following definition of squamous epithelium from a work on human anatomy, by Cleland and Mackay, 1896:

"Squamous epithelium. To this order belong the linings of the heart and blood vessels, lymphatics, serous membranes, and the walls of spaces associated with the lymphatics in the

connective tissues. They are usually now distinguished as endothelia, and while other epithelial cells are either epiblastic, hypoblastic or genito-urinary in origin, endothelium is mesoblastic in origin, and may be derived from the corpuscles in connective tissues."

Most pathologists, however, are as yet far from willing to admit that endothelium and epithelium are the same, for the reason that in pathological processes they possess quite different characteristics, while of vastly greater significance is the fact that in the normal state their functional characters are widely different. For example, in the lower forms of invertebrates, as the worms and metazoa, we find that the mesodermic cells, corresponding to our peritoneal endothelium, approach foreign bodies and engulf them, or, after surrounding them, fuse into a solid mass of nucleated protoplasm, secrete a digestive fluid, and in this way endeavor to destroy them. Do the epithelial cells perform such a function? No, for as Metchnikoff has shown, if, in the larval stage of the metazoa, the ectoderm be punctured through with a fine needle, its cells remain passive, while the mesodermic cells flock to the point of injury, surround the instrument, fuse together, and attempt to digest it. Soluble pigments may be precipitated from the fluids containing them, during their passage through the cells of epithelium, which never ingest solid foreign substances; on the other hand, the power of phagocytosis is a specific function of the cells of endothelium and a few others of the connective tissue group.

In connective tissue proliferations both in the granulomata and in neoplasms, we have the same tendency of the protoplasm to fuse, and, as in tubercle, leprosy and in the presence of foreign bodies, with a definite object in view, viz., the digestion and removal of the invading organisms or substances. This is clearly a functionating power that we do not find in the epithelial cell. The formation of giant cells from proliferating endothelium in a sarcoma of the jaw, as described by Thoma in his recent work on Pathology, is a phenomenon that one would almost never find in proliferating epithelium.

During acute inflammation the endothelial cells throw out pseudopodia and take up foreign bodies; it is well known that in malaria and some bacterial infections they act as phagocytes. In calcareous infiltration the connective tissue, and not the epithelial cells, are affected, though it is said that occasionally epithelium may show a similar change.

According to Ziegler and Thoma, where silver is absorbed through the intestine, as in argyria, the deposits occur, not in the epithelium, but in the connective tissue cells in the papillæ of the skin, in the glomeruli and medullary portions of the kidney, adventitia of the small vessels, connective tissue of the intestinal villi; in short wherever we find abundance of blood vessels and lymphatics, with their lining endothelium.

Surely this is sufficient evidence to show that there are certain vital, important, and positive points of differentiation between these two types of cells, which persist from the embryo, and which we cannot afford to overlook.

It may be said that in the cells lining the infundibula and alveoli of the lung we have epithelial cells that are phagocytic, for at times they take up considerable pigment. Rather, do we not have two kinds of cells in the alveoli, one the thin, flat epithelia, and the other smaller, resembling the endothelial cells of lymphatics or capillaries? It is to be noted that the bulk of the pigment taken up by the lung is deposited finally not in the wall of the alveolus, but in the connective tissue stroma of the organ, beneath the pleura, and about the vessels and bronchi, where we have the largest number of lymphatics with their lining endothelium. The alveolus of the lung is said to be lined by epithelial cells throughout, and the difference in size and appearance of these cells is explained by the statement that at birth, when air first gains access to the alveoli, most of the cells are stretched by the expansion of the saccules and become squamous, and that the other cells, being in excess of the number required to cover the inner surface of the distended alveoli, are not expanded at all, but retain their original size and form, remaining to fill the small interspaces between the larger flattened cells. I am of opinion that these smaller cells are not epithelial cells at all, but endothelial cells, situated in the stomata of the lymphatics, and that they are placed there for the special purpose of taking up and disposing of foreign objects of any kind, bacteria, blood pigment, coal dust, etc., thus performing a valuable office that the epithelial cells cannot do for themselves.

Phagocytosis is a function belonging to cells of the connective tissue group and not to epithelium, which seems to have been set apart generally for protective, filtering or specialized secreting purposes, but which never, after primary differentiation, possesses that vital mechanical activity of protoplasm represented by phagocytosis such as the endothelial cells so often manifest. It might be argued that these phagocytic cells in the alveoli of the lung are epithelial, and that the pigment they contain after hæmorrhages, for instance, is taken up in solution and precipitated by their protoplasm, as in the case of kidney epithelium. To this I reply that they may be seen to contain red blood cells which are intact, proving that they ingest them whole, like the blood-carrying cells of the spleen, which are universally acknowledged to be endothelial.

Now the walls of the alveoli show numerous stomata in the interspaces between their lining cells, and these stomata are the openings of lymphatics. These lymphatics, of course, contain endothelium; then why should not these endothelial cells project into the mouths of the stomata, guarding the openings, if I may so speak, and lying in wait

for any intruder that may come within reach? In this connection I wish to quote from Quain's Anatomy, Vol. III, Part IV, 1896:

> " * * * * But the air cells themselves, both those which are scattered over the respiratory bronchioles and those which cover the infundibula, as well as intermediate portions of the infundibula which occur here and there between the air cells, possess an epithelium of a peculiar character. The cells of this epithelium are of two kinds, viz., large, thin, very delicate cells, irregular in size and shape, lying over the blood vessels, but also, in many cases, extending over the interstices between them; and, (2) small, flat, polygonal, nucleated cells, which lie singly or in small groups of two or three cells, between the others, and always in the interstices of the capillary network. These are similar to the cells which are found in patches in the lobular bronchioles. If the lung is greatly distended they also become flattened out.
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> In the fœtus the lung is entirely lined with small granular pavement cells, but with the distension which follows upon the first respiratory efforts most of the cells become transformed into the large, thin, epithelial elements above described." Then speaking of the post-natal period, "* * * * A number of leucocytes, both granular and eosinophil, are usually to be found free in the air cells and smaller bronchial tubes; not unfrequently they contain carbonaceous particles. By the migration of these cells into the pulmonary tissue, the carbon particles may be conveyed into the substance of the lung and thence into the lymphatics and bronchial glands. * * * *
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> LYMPHATICS. The alveolar lymphatics of the lung take origin from lymphatic capillaries in the inter-alveolar septa, etc. * * * * The branched connective tissue corpuscles and cell spaces with which the lymphatics are in connection at their origin, send processes upward to the inner surface of the air tubes and alveoli between the epithelial cells (like the speudo-stomata of the serous membranes)."

The above statement regarding the variety of epithelium found in the alveoli of the fœtal lung is further supported by the following, taken from Clarkson's Text-book of Histology, 1896, p. 288. Speaking of the lung in the fœtus he says:

> "The epithelium lining the unexpanded air cells differs from that of the air cells of the mature lung in being also unexpanded, that is, it is composed of cubical glandular looking cells instead of flattened squames."

I do not think the above view is the correct one. The sudden, almost

instantaneous, expansion of the protoplasm of a cell from a small cuboidal into a large squamous form, would not be in accordance with Nature's accustomed gradual, more certain, and safer method of transforming cells from one form to another. And then think of the ruptures, hæmorrhage, certainly the œdema that must ensue upon the sudden, violent elongation of the multitude of delicate capillary blood vessels in the alveolar walls, aggravated by the equally sudden distension of the vessels with the blood that must enter them for æration, aided by the suction power of the enormously distended thoracic cavity. It is certainly much more reasonable to suppose that the walls of the alveoli are fully developed with their squamous epithelium prior to birth; that the alveoli contain the fully developed capillary blood vessels, and are simply collapsed, their lateral walls lying in contact; that the organ has attained its full length, but the walls of the alveoli being in apposition, the breadth of the lung is very much less than that of the ærated lung, yet the organ is large enough to fill the unexpanded cavity within which it lies. That prior to birth as well as subsequently there are two varieties of cells upon the alveolar walls, one of these being epithelial and the other smaller connective tissue endothelial cells. In support of this view, and to show that the lungs fill the cavities in which they lie, I quote the following from the American Text-book of Physiology, 1896, p. 504:

> "Before birth the lungs are airless (atelectatic), the walls of the bronchioles and infundibula are in contact, yet in the child before birth, as in the adult, the lungs are in apposition with the thoracic walls, being separated only by the two layers of the pleura."

I would now invite attention to the following statement in the quotation already made from Quain's Anatomy:

> "LYMPHATICS.—The alveolar lymphatics of the lung take their origin from lymphatic capillaries in the alveolar septa. * * * * The branched connective tissue corpuscles and cell spaces with which the lymphatics are in connection at their origin, send processes upward to the inner surface of the air tubes and alveoli, between the epithelial cells (like the pseudo-stomata of the serous membranes)."

It is clear from the above that connective tissue corpuscles reach the inner surface of the alveolus at points between the epithelial cells, and that prolongations of the minute cell spaces with which the ultimate lymphatics communicate also reach the same spots; therefore no other conclusion can be drawn than that these cell spaces are the openings of the lymphatics upon the alveolar walls, guarded by processes of the connective tissue corpuscles. It is never claimed that more than two kinds of cells occur on the inner surfaces of the alveoli, and by again referring to the extract from

Quain's Anatomy it will be seen that one variety consists of "large, thin, very delicate cells, irregular in size and shape, lying chiefly over the blood vessels;" the other of "small, flat, polygonal nucleated cells, which lie singly or in groups of two or three cells, between the others, and always in the interstices of the capillary network." Hence it follows that the smaller cells described above are the connective tissue cells forming the lymph capillaries, which means also that they are endothelial cells, as also would be connective tissue cells occupying the same relation to blood capillaries. Endothelial cells are in their very nature amoeboid and actively phagocytic; therefore, I hold that these are the cells that take up foreign particles in the alveoli of the lungs and convey them into the lymphatics.

I take exception to the statement, "A number of leucocytes both granular and eosinophile, are usually to be found free in the air cells and smaller bronchial tubes, not infrequently they contain carbonaceous particles." Eosinophilic leucocytes, though actively amoeboid, are not phagocytic; they are said to be glandular cells whose secretion is discharged in the presence of bacteria, etc. If the granular cells are mononuclear, they are endothelial cells which have entered the alveolus, probably as a result of the proliferation of those already described in the alveolar walls, which are generally spoken of as "nucleated and granular cells" to distinguish them from the pale and often non-nucleated epithelium. This origin would explain their phagocytic properties, and the designation of these connective tissue cells as "leucocytes" would be only one more instance of a very common error. Should they be leucocytes of the wandering polymorphonuclear type, it would be hard to understand what chemiotactic influence had attracted them from the vessels in such number under normal conditions, for these cells are short-lived outside the vessels, and to maintain their presence there constantly continuous emigration is necessary. That they are connective tissue cells seems quite clear from the description given of them in Vol. II, Quain's Anatomy, 1882, American Edition, as follows:

> "A number of granular rounded amoeboid cells are usually to be found free in the air cells and smaller bronchial tubes; not infrequently they contain carbonaceous particles. By the migration of these cells into the pulmonary tissue, the carbon particles may be conveyed into the substance of the lung and thence into the lymphatics and bronchial glands."

Polymorphonuclear leucocytes, the wandering leucocytes of the blood, if poured out in sufficient numbers to remove pigment from the alveoli, would in cases of chronic passive congestion with haemorrhage, for instance, be required in such numbers as to constitute a purulent infiltration. The microscope shows that no such condition is present, and I can arrive at no other conclusion than that the pigment-carrying cells both in the alveoli and lymphatics are not leucocytes but swollen endothelial cells.

I freely acknowledge that if such a growth as the one under consideration projected into the bladder, I should unhesitatingly pronounce it a papillomatous adenoma, or adeno-carcinoma, as the case might be, because it is impossible to say in such circumstances whether a large cell with juicy protoplasm is derived from epithelium or connective tissue, judging from its appearance under the microscope alone. Fortunately for us, there is a tendency in new growths to the reproduction of the type of tissue from which they take their origin; then again it is exceptional for psammomatous bodies to occur (if indeed they ever do) in other than connective tissue cells, and in this case, the point of origin, age of the patient, envelopment of the growth by the pia mater, and the nature of the contents of the dilated spaces, made the diagnosis comparatively easy.

In closing I take pleasure in acknowledging my obligations to Professors Welch and Flexner of the Johns Hopkins University, the former of whom confirmed the diagnosis, while the latter reviewed the paper with me at the time it was first written.

HYDROLOGY OF THE CHAGRES RIVER.

By General Henry L. Abbot, U. S. A., Professor of Hydraulic Engineering.

Few better examples than the Panama Canal can be found to illustrate how great engineering works of the present day may demand elaborate investigation of physical phenomena, and the application of known laws and of refined methods of research before it is judicious to form plans and to enter upon actual construction.

Since the catastrophe of M. de Lesseps', to whom such information was lacking, the physics and hydraulics of the Chagres River have been under close study for sixteen years. The accumulated data are probably more complete than for any river of its size in the United States, and its tropical peculiarities of basin and climate while adding certain local difficulties eliminate important complications encountered in conducting such investigations in more temperate regions. For these reasons the stream possesses peculiar attractions for the student of river hydraulics.

Its basin is but little elevated above the sea, the bounding hills rarely exceeding a thousand or fifteen hundred feet in height, but the stream in its upper ramifications winds through gorges that favor a rapid delivery of the torrential downpours of the rainy season, lasting for eight or nine consecutive months of the year. Near the Atlantic coast the annual rainfall is about 140 inches, and in the interior about 100 inches; and rain may be expected on about 250 days in the year. The mean annual temperature is 80 degrees Fah. with no sensible variation from month to month. The soil containing much clay is chiefly composed of denuded tertiary deposits, with occasional veins and coulées of ancient irruptive material. The whole district beyond the few settlements is clothed with the luxuriant growth of the tropics so densely disposed as almost to defy passage. A river which serves to interpretate the hydraulics resulting from such conditions, and which is exempt from the troublesome complications caused by frost and by irregular rainfall certainly presents a fascinating and profitable subject for study.

The stream in the dry season of three or four months is clear, but in the rainy season it carries a moderate amount of sedimentary matter in suspension, less however, than might be supposed from the color of the water, for the material is fine and light; no delta has been formed at the mouth of the river. There are, however, deposits in favorable places in the channel, consisting chiefly of mud swept into the river by the sudden freshets; and some moving sand bars are occasionally encountered, especially in the upper river.

The effect on its regimen of the increasing declivity of the bed of the stream, as its course is followed up, is well marked. Near the coast the region traversed is so flat that even at Bohio, twenty-seven miles above the mouth, the water surface in the extreme low stage is only about a foot above mean tidal level at Colon where the tidal oscillation is about a foot and a half. At this stage a well marked tidal oscillation has been measured at Bohio of about two or three inches, being of the diurnal or single day type. The flatness of this lower district, of twenty-seven miles by the course of the stream, exerts a controlling influence upon the range of oscillation in times of flood. To gain the requisite head to carry the volume from Bohio to the sea, with no declivity in the bed to assist, the water piles up, so to speak, making the extreme range between high and low water (39.4 feet) at this locality greater than at any other on its entire course. In the next twenty miles, from Bohio to Gamboa, the bed rises about forty-five feet and this natural slope of about two and a half feet to the mile aids in restricting the flood range to about thirty-seven feet. Thence to Alhajuela, a distance of eleven miles, the bed rises forty-six feet more, which is too much for the flow at low stages, so that at such times eighteen or more rapids occur. In floods, this reserve supplies an effective motive power to carry forward the increased volume. No really great flood has been instrumentally gauged at Alhajuela, but measurements on very large freshets demonstrate that the extreme flood range can hardly exceed about eighteen or twenty feet. In this district the stream itself has registered its torrential character upon the channel. The bars, distinctly visible at low stages, differ widely in composition, some being of pure sand, others of pebbles, and others of rounded stones three or more inches in diameter; there is little or no mixing of materials. This sorting is attributable to the frequent freshets and occasional floods soon to be considered.

A short distance above Alhajuela the river forks, the principal branch, the Pequeni, heading near Porto Bello on the Atlantic coast. The other retaining the name Chagres heads more to the south in the Cordillera de San Blas. This upper district has been little explored, and is traversed only by a trail connecting the city of Panama with Porto Bello, and which is impassable or nearly so in the rainy season. The area is approximately 320 square miles, and has an annual rainfall of about 112 inches. It is drained by many streams following devious routes to one or the other of the two main forks. The annual outflow from this upper basin is about 2,000 cubic feet per second. In traversing the next basin, from Alhajuela to Gamboa, 130 miles in extent, where the annual rainfall is 98 inches, the river receives a joint contribution from fifteen affluents of about 550 cubic feet per second. Thence to Bohio it receives the drainage of 230 square miles where the annual rainfall averages 114 inches and the outflow from 17 tributaries is about 1075 cubic feet per second. These valuations of rainfall and outflow are based on the results of six years continuous and

elaborate observations between 1897 and 1904. The average discharge of the river at Bohio measured during fourteen years is larger, in the ratio of 4,798 to 3,625 cubic feet per second, with a minimum of 3,384 in 1899. Indeed the Isthmus is subject to the recurrence of successive periods of increasing and diminishing rainfall covering several years; and the same is true for Nicaragua, although there appears to be no correllation between the two. Such differences in rainfall are of course reflected in the outflow. In as much as the number and duration of the freshets virtually determine the annual discharge, a study of periodic flow may be carried back several years before regular gaugings began, for the fluviograph was established at Gamboa in 1883. Records are lacking for 1889 and are incomplete for 1896 and 1897. Dividing the available eighteen years prior to the transfer of the property to the United States into periods of six years, we find that in the first period there were annually thirty-four freshets giving 455 hours above the lower limiting level (10 feet above low water), with a local rainfall of 102 inches. The second period showed twenty annual freshets, 214 hours, and 99 inches. The last period gave only eleven annual freshets, 93 hours and 88 inches. Subsequently, there have been in 1904 thirteen freshets, 94 hours and 84 inches; and in 1905 six freshets, 48 hours, and 82 inches. These indications are fully confirmed by the discharges actually measured at Bohio during the second and third of the above periods. For the second six years the average annual volume was 5,826 cubic feet per second, and for the third period 3,805 cubic feet; in 1904 it was 4,110 and in 1905 2,800 cubic feet. These records suggest that a minimum epoch is now passing, and that guided by usual experience we may expect soon to enter upon a period of increasing rainfall and river discharge. The first French company apparently labored under conditions differing but little from the probable maximum.

Below Bohio the hydraulic data are less full than above, as this district was of comparatively little importance in the solution of the problem of how to complete a canal already essentially completed as far as Bohio. The Chagres here receives two important affluents, the Trinidad with a basin of about 319 square miles, and the Gatuncillo with one of about 156 square miles, both having an annual rainfall of about 137 inches. The total basin of the river above Gatun is thus about 1,225 square miles in extent, with an annual outflow estimated at not less than 8,100 cubic feet per second; that in the three dry months being not less than 1,225 cubic feet.

But it is in the nature of its flow in the rainy season that the Chagres shows its most marked characteristics. As is always the case in the dry season, its usual character is that of a quiet stream oscillating slightly about a level raised only some four or five feet above the low water stage; but as indicated above it may be expected in its upper course to mount two or three times in a month, 10, 15 or 20 feet only to subside within twenty-four hours nearly to the same level as before, having in the process increased its volume from 2,000 or 3,000 to 20,000, 30,000, or even 50,000 cubic

feet per second. These sudden freshets are caused by downpours of an inch or more in twenty-four hours. When such cloud bursts cover the entire basin and continue for several days they cause the so-called great floods, which have carried at Gamboa about 80,000 and at Bohio about 115,-000 cubic feet per second. Fortunately they are rare, only six having occurred in more than half a century. The freshets, however, are common and they sweep down the channel like great waves, their crests moving at a velocity of about four and a half feet per second, that of the water itself in the upper course being some 12 feet, and at Bohio some 8 feet.

It is needless to say that an intelligent study of the canal problem has demanded a precise knowledge of the fluctuating volumes carried by so variable a stream. How was this knowledge to be obtained? While actual gauging of the flow must constitute the basis of the estimations it was clear that this method alone would fail to meet the needs of the case. Freshets occurring in the night would largely escape measurement, although trials with floats carrying lights were actually attempted by the engineers of the Company. To secure a precise knowledge of the total flow of a stream liable to such variations from moment to moment, would demand continuous manipulation of the instruments for long periods. Hence dependence must be placed on the automatic records of water level supplied by the fluviographs, interpreted by rating tables so constructed as not only to recognize the varying phases of the flow but also to furnish a trustworthy valuation of the volume which passed in the standard flood of 1879, the greatest of record for half a century, and of which a knowledge of the critical heights attained has been preserved. Evidently in framing such rating tables the usual method of measuring the volume passing at a few different stages, connecting the platted points by lines, and extending the scale by judgment to the undetermined levels would not serve the purpose.

This river presents two fundamentally different conditions, one when the flow is nearly constant and the volume is governed by the area of cross section and the normal surface slope, largely influenced at each locality by that of the bed; but during freshets the local slope at any given stand must also be powerfully affected by the position of the crest of the wave, increasing as it approaches and diminishing after its passage. Indeed it is a well-known law of river hydraulics that in sudden rises the volume at each level is excessive during the rise, diminishes as the maximum level is attained, and becomes smaller during the fall.

In framing rating tables to meet these conditions the following method was adopted. For each of the three important stations where fluviograph records had been kept, the thousands of gaugings, covering a wide range of water levels, were grouped accordingly and the general average at each level was computed and platted. The law of increase of this mean curve was studied and represented by an algebraic formula. The latter was then adjusted to the observed values either by the method of least squares or by equations of conditions compelling it tc pass through the largest pos-

sible number of points, so chosen as to make it conform closely throughout the entire range. By this method of framing the rating tables the volumes indicated at water levels beyond the limits of the actual gangings were determined by the general law of the curve and not by an arbitrary extension determined by the judgment of the computer.

To meet the case of the violent freshets another refinement was necessary. All rivers under the exceptional slopes existing at such times carry volumes diverging from the general law of increase, and usually require different rating tables containing a function of the height at which the sudden rise began. Fortunately in the case of the Chagres the starting level is always found at so low a point that one freshet formula at each locality suffices. Very many gaugings taken at such times were available, and they were studied in the manner indicated above, to frame a formula to represent the median line between the rising and falling branches. By this method the rating tables representing the formula would give correctly the total volume passing during the entire freshet, although the volume indicated at any given level would be too small during the rise, and too large during the fall, but nearly correct at the highest point attained.

By this general method the daily discharge at Bohio, Gamboa and Alhajuela has been computed from the time when the property passed into the hands of the Receiver, and later from him to the New Company, and finally to the United States; and the same work is still continued under the Commission. To supply some early dates when fluviograph records were lacking, use has been made of the method by transfer. The relative volume carried at the three stations is an important and useful element in the hydrography of the river, and has received careful study. The ratios in the dry season vary but little from year to year, and the same is true in the rainy season; but there is a considerable change between the two seasons, as naturally would be expected. The value of all of them have been determined with small probable errors, from the large number of months available; and they permit a missing month to be supplied from the volume measured at the adjacent station, without much risk of inaccuracy. It is only at Alhajuela, however, where such interpolation has been used largely in completing the fourteen years' record of monthly discharges. The well established fact that the volume carried at Gamboa in the rainy months is only two-thirds of that passing Bohio, proved to be an important element in deciding the question of the type of canal; and this well illustrates the practical importance of such technical researches.

But perhaps the most interesting contribution to the science of river hydraulics resulting from the investigations accorded to this tropical river is in connection with the elaborate measurements of the ratio between downfall and outflow in the basin above Bohio. Such studies, of primary importance in connection with the water supply of cities, with works of irrigation, and with those for the generation of mechanical power, are usually handicapped in temperate regions by frost and snow in the winter,

and by irregularly distributed precipitation at all seasons of the year. At Panama frost is unknown, and the rainfall, regulated by the motion of the sun in declination and by the adjacent seas, is relatively subject to unvarying law. One of the important engineering problems of the canal demanded an elaborate study of this ratio, but the results have a wider application as throwing light upon the general question of what becomes of the water falling from the clouds.

This matters was studied in detail both for the basin above Bohio and for that above Gamboa, including as a check each of the three separate sub-basins into which the former is naturally subdivided. The general results based on the records of six consecutive years are the following. In the month of May, the end of the dry season, the normal value of the ratio is 0.3 with a probable error of 0.03 determined from 23 different measurements in the several basins. From this date its numerical value gradually and quite regularly increases until the month of November, when the sun is lingering near the winter solstice and the moisture-laden winds from the Caribbean sea are sweeping over the Isthmus so continuously as to cause the heaviest rainfall of the year. Its value is then about 0.8, and it rapidly increases above unity, reaching a fictitious value of two or three units in February, the driest month of the entire year. It then subsides rapidly, in March and April, to the annual minimum in May. The physical explanation of this variation is manifest. Upon the advent of the rainy season the earth gradually absorbs a part of the water falling from the clouds, thus preventing it from finding its way directly to the streams; but as time passes, and the earthern reservoir gradually fills, it discharges an increasing volume of ground water to augment the direct flow of the river. When the supply from the clouds ceases the reservoir is soon more or less exhausted by the continued flow of ground water, and the ratio reaches its minimum. In other words, the considerable outflow in the dry season, greatly exceeding the entire rainfall, is supplied mainly by ground water; and even in the rainy season especially near its terminus an important part of the river discharges percolates to it through the ground. It would seem probable that the average time of passage is about three months, and that if the length of the dry season were longer the flow might practically cease, as is now the case with the smaller affluents.

An analysis of the results of these researches indicates that of an average annual downfall of 111.5 inches, in this basin of 700 square miles, 73.4 inches found their way to the river either directly or through the ground, and that 38.1 inches disappeared by evaporation, by plant absorption, and possibly by deep penetration into the earth itself. Incidentally they confirmed the views of the geologists that there need be no fear of undue loss of water from the artificial lakes demanded for canal purposes; and confirmed the inference drawn from borings that there is a small flow of water through a permeable stratum existing near the bottom of the ancient

gorge, about 160 feet deep, separating the bluffs between which the river flows at Bohio.

It is of interest to seek among American streams an example suited to illustrate how so great differences in fundamental conditions may combine to produce a river carrying similar volumes to the sea. The Roanoke River above Neal, North Carolina, is not unlike the Chagres above Bohio, from this point of view. Simultaneous gaugings made in 1896 at Neal and Bohio (the former by the Geological Survey) indicated for five consecutive months average discharges of 5,761 and 5,849 cubic feet per second respectively. Both basins are largely covered by forests in their upper courses and contain swamps in their lower districts, but the tropical growth is much the more dense. Both are subject to sudden floods, but those of the Roanoke cover several days while those of the Chagres rarely exceed a few hours. The low water discharge of the former is larger than that of the latter, being about 2,000 cubic feet per second to compare with 1,000; but the great floods of the Chagres are larger in the proportion of about 115,000 to 83,000 cubic feet per second. The extreme range of the Roanoke is about 30 feet, that of the Chagres being about 40 feet. The explanation of these different regimens is found in the respective areas of the basins, that of the Roanoke being about 8,717 square miles and that of the Chagres being 700 square miles; and in the respective annual precipitation, which is about 51 inches to compare with about 112 inches.

In the days of the contest over the proper route to select for the canal wild statements were made about the ungovernable floods of the Chagres. The truth is that they are less so than those of some of our own streams now under improvement. For example, the Warrior River and its affluent the Black Warrior, in Alabama, have shown at Tuscaloosa an oscillation of 67 feet with a rise of 20 feet in four hours. Such extremes have never been approached by the Chagres.

In conclusion it may be said that the dominating element in deciding what type of canal should be adopted at the Isthmus of Panama is neither more nor less than this excentric little river; and that the long years that have been devoted to its study have been well expended. They have made certainly known that all which is required is a judicious system of regulation by well understood engineering methods. Had this knowledge been available at the inauguration of the work under M. de Lesseps, hundreds of millions would have been saved.

PREVENTIVE MEDICINE.

By General George M. Sternberg, U. S. A., Professor of Preventive Medicine.

From the earliest times physicians have taken the lead in all that relates to the prevention of disease. In times of epidemic their advice is sought by afflicted communities and they have been instrumental in securing most of the legislation which has been enacted with a view to preventing or restricting the prevalence of infectious diseases. As members of boards of health, they are largely responsible for the enactment and execution of proper sanitary legislation, and as medical officers of the Army and Navy, they are charged with the duty of guarding the health of soldiers and sailors enlisted in the service of their country.

While the principal function of a physician engaged in civil practice is to give proper advice and treatment to the sick, he is constantly called upon to point out the most effectual methods of preventing the extension of infectious diseases in the homes of his patients; to indicate the proper diet and mode of life to be followed by convalescents and other members of families which he regularly attends, etc., All this he does cheerfully, although he rarely receives any compensation for advice of this kind and his professional income is diminished in direct proportion to his success in the prevention of disease among the families constituting his clientele.

The compensation for voluntary work in public or domestic sanitation is to be found in the consciousness of good accomplished and of high and humane motives worthy of the profession, and the willingness to perform such voluntary service is one of the most noteworthy distinctions between the educated and honorable physician and the ignorant and mercenary quacks who prey upon the community with no other object in view than that of gain. The beneficent results of preventive medicine are seen in the greatly reduced mortality rates in civilized countries generally, and especially in the fact that certain pestilential maladies which formerly prevailed as wide-spread and devastating epidemics, causing the death of hundreds of thousands of human beings annually, have to a great extent lost their deadly potency as a result of the progress of our knowledge with reference to their etiology and the best methods of combating them. Small-pox no longer claims its victims in any considerable numbers except in communities where vaccination is neglected; cholera has been excluded from our country during the last two widespread epidemics

in Europe and its ravages have been greatly restricted in all civilized countries into which it has been introduced; the deadly plague of the seventeenth and eighteenth centuries is no longer known in Europe and the prevalence of typhus—so-called spotted or 'ship fever'—has been greatly limited. Typhoid fever, tuberculosis and dyphtheria are still with us and claim many victims, but we know the specific cause of each of these diseases; we know where to find the bacteria that cause them and the channels by which they gain access to the human body; and we know how to destroy them by disinfecting agents.

The mortality from tuberculosis is constantly diminishing in our large cities and the complete destruction of the infectious sputa of those suffering from pulmonary tuberculosis would no doubt go a long way towards the extermination of this fatal disease.

Perhaps the triumphs of preventive medicines can not be better illustrated than by a brief historical account of the prevalence of bubonic plague during the past three or four centuries. It can scarcely be doubted that the 'black death' of the fourteenth century was the same disease which subsequently prevailed in Europe under the name of 'the plague'—now more generally spoken of as 'bubonic plague.' While modern methods of diagnosis have enabled us to recognize typhoid fever, typhus fever, relapsing fever and bubonic plague as distinct diseases, it must be remembered that up to the end of the fifteenth century no such differentiation had been made and the term 'pest' was applied to any fatal malady which prevailed as an epidemic, and no doubt in some instances included smallpox, which prior to the discovery of Jenner contributed largely to the general mortality of the population of Europe.

Bubonic plague continued to prevail in various parts of Europe at the end of the sixteenth century, and early in the seventeenth century (1603) an epidemic occurred in London which caused the death of 38,000 of its inhabitants. It continued to prevail in this city and in various parts of England, Holland and Germany and six years later caused a mortality of 11,785 in the city of London. During the year 1603 a most disastrous epidemic occurred in Egypt, which is said to have caused a mortality of at least a million. After an interval of ten or fifteen years, during which there was a marked diminution in the number of cases and the extent of its distribution in European countries, it again obtained wide prevalence during the year 1620 and subsequently, especially in Germany, Holland and England. The epidemic in the city of London in 1625 caused a mortality of more than 35,000. In 1630 a severe epidemic occurred in Milan, and in 1636 London again suffered a mortality of over 10,000, while the disease continued to claim numerous victims in other parts of England and on the continent. Later in the century (1656) some of the Italian cities

suffered devastating epidemics. The mortality in the city of Naples was in the neighborhood of 300,000, in Genoa 60,000, in Rome 14,000. The smaller mortality in the last-named city has been ascribed to the sanitary measures instituted by Cardinal Gastaldi. Up to this time prayers, processionals, the firing of cannons, etc., had been the chief reliance for the arrest of pestilence, with what success is shown by the brief historical review thus far presented. But this enlightened prelate inaugurated a method of combating the plague and other infectious maladies which, with increasing knowledge and experience in the use of scientific preventive measures, has given us the mastery of these pestilential diseases, and has been the principal factor in the extinction of bubonic plague from the civilized countries of Europe.

But it was long after the time of Cardinal Gastaldi before sanitary science was established upon a scientific basis and had acquired the confidence of the educated classes. Indeed, the golden age of preventive medicine has but recently had its dawn, and sanitarians at the present day often encounter great difficulty in convincing legislators and the public generally of the importance of the measures which have been proved to be adequate, when properly carried out, for the prevention of this and other infectious maladies.

We have now arrived in our review at the perind of the 'great plague of London.' For some years this city had been almost if not entirely free from the scourge, but in the spring of 1665 it again appeared and within a few months caused a mortality of 68,596 in a population estimated at 460,000. This, however, does not fairly represent the percentage of mortality among those exposed, for a large proportion of the population flew from the city to escape infection.

Upon the continent the disease prevailed extensively, especially in Austria, Hungary and Germany. The epidemic in Vienna in 1679 caused a mortality of 76,000. In 1681 the city of Prague lost 83,000 of its inhabitants. During the last quarter of this century the disease disappeared from some of the principle countries of Europe. According to Hirsch it disappeared from England in 1679, from France in 1668, from Holland about the same time, from Germany 1683 and from Spain in 1681. In Italy it continued to prevail to some extent until the end of the century.

At the beginning of the eighteenth century bubonic plague prevailed in Constantinople and at various points along the Danube; from here it extended in 1704 to Poland, and soon after to Silisia, Lithuania, Germany and the Scandinavian countries. The mortality in Stockholm was about 40,000 thousand. The disease also extended westward from Constantinople through Austria and Bohemia.

In 1720 Marseilles suffered a severe epidemic, probably as a result of the introduction of cases on a ship from Leghorn. The mortality was estimated as being between 40,000 and 60,000. From Marseilles

as a center it spread through the province of Provence, but did not invade other parts of France. In 1743 a severe outbreak occurred on the island of Sicily. A destructive but brief epidemic, which is estimated to have caused a mortality of 300,000 occurred, during the years 1770 and 1771 in Moldavia, Wallachia, Transylvania, Hungary and Poland. At the same time the disease prevailed in Russia, and in 1771 caused the death of about one fourth of the population of the city of Moscow.

Early in the nineteenth century (1802) bubonic plague appeared at Constantinople and in Armenia. It had previously prevailed in the Caucasus, from which province it extended into Russia. In 1808 to 1813 it extended from Constantinople to Odessa, to Smyrna and to various localities in Transylvania. It also prevailed about the same time in Bosnia and Dalmatia. In 1812 to 1814 it prevailed in Egypt, and, as usual, was conveyed from there to European countries. During the same year it prevailed extensively in Moldavia, Wallachia, and Bessarabia. In 1831 it again prevailed as an epidemic in Constantinople and various parts of Roumelia, and again it appeared in Dalmatia in 1840 and in Constantinople in 1841. Egypt, which for centuries had been the principal focus from which plague had been introduced into Europe, continued to suffer from the disease until 1845 when it disappeared from that country.

The last appearance of oriental plague in Europe, until its recent introduction into Portugal, was the outbreak on the banks of the Volga in 1878-79.

The termination of an epidemic in the pre-sanitary period depended to a considerable extent upon the fact that those who suffered a mild attack acquired thereby an immunity; and that when the more susceptible individuals in a community had succumbed to the prevailing disease there was a necessary termination of the epidemic for want of material.

Another factor which no doubt has an important bearing upon the termination of epidemics is a change in the virulence of the germ as a result of various natural agencies. Time will not permit me to discuss this subject in its scientific and practical aspects, but the general fact may be stated that all known disease germs may vary greatly in their pathogenic virulence, and that in every infectious disease mild cases may occur, not only because of the slight susceptibility of the individual, but also because of the 'attenuated' virulence of the specific germ. In the eighteenth century, the beginning of sanitary science, isolation of the sick and seaboard quarantines came to the aid of these natural agencies, and did much in the way of arresting the progress of this pestilential disease. At the present day these measures, together with disinfection by heat or chemical agents, are relied upon by sanitarians with great confidence as being entirely adequate for the exclusion of this disease or for stamping it out if it should

effect a lodgment in localities where an enlightened public sentiment permits the thorough execution of these preventive measures; but when the disease prevails among an ignorant population which strenuously objects to the carrying out of these measures, the contest between the sanitary officer and the deadly germ is an unequal one, and the stamping out of an epidemic becomes a task of great magnitude, if not entirely hopeless. This is illustrated by the experience of the English in their encounter with bubonic plague in their Indian Empire.

Plague seemed to be almost a thing of the past and no longer gave any uneasiness in the countries of Europe which had formerly suffered from its ravages, when in February, 1894, it made its appearance in the city of Canton, China, and three months later in Hong Kong. The disease is known to have been epidemic in the province of Yunnan, which is about 900 miles distant from Canton, since the year 1873, but it attracted little attention until the lives of Europeans living in the city of Hong Kong were threatened by the oubreak of an epidemic among the Chinese residents of that place. Many thousands of deaths occurred in Canton during the three months which elapsed after its introduction to that city before it effected a lodgment in Hong Kong.

Fortunately this outbreak gave the opportunity for competent bacteriologists to make scientific investigations relating to the specific cause of this scourge of the human race and to the demonstration that it is due to a minute bacillus. This discovery was first made by the Japanese bacteriologist, Kitasato, who had received his training in the laboratory of the famous Professor Robert Koch, of Berlin. This discovery was made in the month of June, 1894, in one of the hospitals established by the English officials in Hong Kong. About the same time the discovery was made, independently, by the French Bacteriologist, Yersin. From this time the study of the plague has been established upon a scientific basis and very material additions have been made to our knowledge with reference to the prevention and treatment of the disease.

That the plague bacillus has not lost any of its original virulence is amply demonstrated by the high death-rate among those attacked, and we are justified in ascribing its restricted prevalence to the general improvement in sanitary conditions in civilized countries and to the well-directed efforts of public health officers in the various localities to which it has been introduced during recent years. In the Philippine Islands, where it prevailed to a considerable extent when our troops first took possession of the City of Manila and where the conditions among the natives are extremely favorable for its extension, it has been kept within reasonable bounds and, indeed, the latest reports indicate that it has been practically exterminated by the per-

sistent efforts of the medical officers of our army, charged with the duty of protecting the public health in those Islands.

Bubonic plague, cholera and typhoid fever have long been classed as 'filth disease,' and in a certain sense this is correct, although we now know that the germs of these diseases not only are not generated by filth, but do not multiply in accumulations of filth. They are present, however, in the alvine discharges of the sick, and when this kind of filth is exposed in the vicinity of human habitations or gains access to wells or streams, the water of which is used for drinking, the germs are likely to be conveyed to the alimentary canals of susceptible individuals, and thus the disease is propagated. Until recently the attention of sanitarians was so firmly fixed upon the demonstrated transmission of cholera and typhoid fever through the agency of contaminated water or milk that certain other modes of transmission were overlooked, or at least underrated. I refer to the transmission by insects, or as dust by currents of air. I have for many years insisted upon the part played by flies as carriers of infectious material from moist masses of excreta from cases of cholera and typhoid fever. There is good reason to believe that the bacillus of bubonic plague may be transmitted in the same way. The cholera spirillum is quickly killed by desiccation and this disease is probably very rarely, if ever, communicated through the medium of dust. But the germs of typhoid fever and of bubonic plague are more resistent and, without doubt, under certain circumstances, these diseases are extensively propagated by means of dust containing desiccated excreta. There is a good reason to believe that in several of our camps, during the Spanish-American War, this was an important factor in the etiology of typhoid fever epidemics. The average mortality from typhoid fever in our regular army since the Civil War has been, for the first decade (1868-1877 95 per 100,000 of mean strength; for the second decade (1878-1887) 108 per 100,000, for the third decade (1888-97) 55 per 100,000. This latter rate compares favorably with that of many of our principal cities; for example, it is exceeded by the typhoid death-rate of the city of Washington, which is 78.1 per 100,000 (average of 10 years, 1888-1897, by that of the city of Chicago, which is 64.4 per 100,000; by that of Pittsburgh, which is 88 per 100,000. As a result of insanitary conditions existing in the camps in which our troops were hastily assembled at the outset of the Spanish-American War, the typhoid death-rate in our army of volunteers and regulars during the year ending April 30, 1899, was more than 22 times as great as it had been in our regular army during the decade immediately preceding the war period. As compared with the Civil War, however, there was a decided improvement, the typhoid mortality for the first year of the Civil War

having been 1,971 per 100,000 of mean strength and for the Spanish-American War 1,237 per 100,000.

Experience shows that new levies of troops are especially subject to typhoid fever and other infectious 'camp diseases,' not only because of lack of discipline and consequent difficulty in the enforcement of sanitary regulations, but also because the individual soldiers are very susceptible to infection, owing to their age, the abrupt change in their mode of life, the exposure and fatigue incident to camp life, and last, but not least, their own imprudence as regards eating, drinking, exercise, etc. In the absence of sewers or other adequate means of removing excreta, the camp site is likely to become infected by the discharges of unrecognized cases of typhoid and typhoid bacilli are carried by flies to the kitchens and mess-tents and deposited upon food, or as dust are directly deposited upon the mucous membranes of the respiratory passages of those living in the infected camp. That preventive medicine has still serious work before it is shown by the fact that according to the last census return there were 35,379 deaths from typhoid fever in the United States during the census year 1900. The increase in mortality over the number in 1890 (27,056) is out of proportion to the increase in population, notwithstanding the general improvement in the sanitary condition of towns and cities. This is no doubt due to the continued pollution of water supplies and to the extension of this infectious disease in rural districts. It is in fact now an endemic disease in nearly all parts of the United States.

According to the census report of 1900, there were 111,000 deaths from tuberculosis during the year 1900. This does not, however, include the deaths in certain states in which the vital statistics are incomplete or unreliable, and it is probable that there are at least 145,000 victims of the great white plague annually within the limits of the United States. The last census return in those states where registration was approximately correct, including a population of about 21,000,000 people, shows that 12 per cent. of all deaths resulted from pulmonary tuberculosis, 8.5 per cent. from pneumonia, 3 per cent. from typhoid fever and 3 per cent. from dyphtheria and croup. These figures indicate to some extent the task which preventive medicine has still to accomplish.

A most interesting and notable example of the beneficent results following the practical application of sanitary measures based upon exact knowledge relating to the etiology of an infectious disease is afforded by the recent extinction of yellow fever in the city of Havana, which for many years had been the principal focus of infection in the West Indies, and the port from which it has been repeatedly carried to the seaport cities of the United States. During the first sixty years of the past century, yellow fever prevailed almost annually in one or more of the southern seaports of the United States and not

infrequently it extended its ravages to the interior towns in one or more of the southern states. So frequently did it prevail during the summer months in New Orleans and Charleston that the permanent residents of those cities commonly regarded it as a disease of the climate and a necessary evil which it was folly to attempt to combat by quarantine restrictions.

In the great epidemic of 1853, yellow fever prevailed extensively in the states of Florida, Alabama, Louisiana, Mississippi, Arkansas and Texas. The epidemic of 1867 was limited to the states of Louisiana and Texas. Those states again suffered severely in 1873 and the states of Florida, Alabama and Mississippi were also invaded. A still more extended and deadly epidemic occurred in 1878, causing a mortality of 15,934 out of a total number of cases exceeding 74,000. In this epidemic the disease followed the Mississippi River to the very suburbs of St. Louis, and the state of Tennessee suffered severely as well as the states south of it. The city of Memphis alone had a mortality from the disease of about 5,000. These repeated epidemics not only cost the lives of thousands of citizens and paralyzed business of all kinds during their prevalence, but apprehension with reference to the recurrence of the disease very materially interfered with the growth of many southern cities and retarded greatly the development of those portions of the country most liable to invasion. All this is now changed; public health officials are no longer filled with apprehension upon the approach of summer by the thought that any ship arriving from Havana may introduce the deadly pestilence to our shores; commerce is no longer subjected to the serious restrictions formerly considered necessary for the exclusion of the disease; and the public generally have been made aware that the fangs of this threatening monster have been drawn by the scientific demonstration of its mode of attack and the simple measures which have been proved to be effective in preventing its propagation. Until the recent demonstration of the transmission of yellow fever by mosquitoes, this disease was generally regarded as one of the filth diseases, although there were many facts opposed to this view. In the light of our present knowledge we can no longer class it with typhoid fever, cholera, bubonic plague and dysentery, in which diseases the germ is known to be present in the alvine discharges of the sick and which are, consequently, well named filth diseases.

We now see clearly, however, why in certain particulars relating to its etiology it resembles the malarial fevers. It is limited as regards its prevalence to comparatively warm latitudes or to the summer months in more temperate regions and is dependent, to a certain extent, upon rainfall or the proximity of standing water, because these conditions are necessary for the propagation of mosquitoes. As regards the filth diseases, properly so-called, no single agency is more important for their prevention than the use of properly constructed

sewers for the reception of excreta and its removal from the vicinity of human habitation. Sewers had come into use and had the warm endorsement of sanitarians long before the discovery of the germs of the infectious maladies under discussion, and before it was positively known that the infectious agent in these diseases is contained in the discharges from the bowels. But now that we have an exact knowledge of the etiology of these diseases, the reason for the beneficent results attending the use of sewers, in connction with an ample and pure water supply, is apparent. It may be safely asserted that a city or town having a complete and satisfactory sewer system and a pure water supply is practically immune from epidemics of cholera or typhoid fever, provided, of course, that the sewers are used for the purpose for which they are intended, and that streets and back yards no longer serve as receptacles for filth, as was usual during the presanitary period even in great cities like London and Paris. The axiom 'tout a l'égout' now governs the practice not only in Paris, but wherever the fundamental principles of municipal sanitation are understood and sewers have been constructed. Unfortunately, the cost of sewer construction, the reluctance of tax-payers to part with their money and the ignorance or indifference of municipal authorities have conspired to prevent the accomplishment of this fundamental sanitary measure in very many towns in the United States, and our endemic plague—typhoid fever—continues to claim a large annual quota of victims in such localities. Even in the national capital our sewer system is incomplete and in many out-of-the-way places, especially in the densely populated alleys of the city, shallow box privies are in use as receptacles for human excreta and the typhoid fever rate, owing to this and other causes, is disgracefully high.

Mortality rates in towns and cities throughout the civilized world depend to a large extent upon the purity of the water-supply and the efficiency of the system of sewerage disposal; and the constant improvement which is shown by the mortality statistics of England and other countries which have made the most progress in this direction is undoubtedly largely due to these two factors. This is well illustrated by the mortality statistics of armies. In the German army the annual death-rate in 1868 was 6.9 per thousand, a decade later it was 4.82, in 1888 it had fallen to 3.24 and in 1896 to 2.6. In our own army, the death-rate during the period of peace just prior to the Mexican War (1848) was about three and one half times as great as during the five years preceding our recent war with Spain, and since the year 1827 there has been a diminution of the death-rate of nearly forty per cent. In the British army at home stations the mortality rate during the decade ending in 1884 was 7.2 per thousand, in 1889 the rate had fallen to 4.57 and in 1897 to 3.42. In the Italian army there has been a gradual and progressive reduction from 13.3 per thousand in 1875

to 4.2 in 1897. The mortality in the French army was a little over 21 per thousand during the five years ending in 1825. In 1890 it had fallen to 5.81. per thousand.

According to the best estimates the average of human life in the sixteenth century was somewhat less than twenty years. At the present time it is more than twice as long and during the past twenty-five years the average duration of life has been lengthened about six years. During the first thirty-five years of the past century the vital statistics of the city of London showed a mortality of about 29 per thousand. At the present time the mortality in that great city has been reduced to from 17 to 19 per thousand. Even more notable results have been obtained in many parts of the civilized world as a result of increased knowledge and improved methods for the prevention of infectious diseases and the general improvement in hygienic conditions.

A STUDY OF THE TELLURIDES: THEIR FORMATION AND CHEMICAL PROPERTIES.*

By Cabell Whitehead, B.M., M.S.

The tellurium used in my work was obtained from the residues from the electrolytic refining of copper. These residues, technically known as "slimes," consist of the silver, gold, lead, arsenic, antimony, tellurium, and selenium or their compounds found in small amounts as impurities in the smelted copper, and which in the electrolytic refining process, collect in the bottom of the refining vat as a mud or slime. In the course of the separation from this slime of the silver and gold, most of the arsenic, antimony and lead are also slagged off or volatilized, and there remains a very hygroscopic mass which consists largely of alkaline tellurites and selenites, produced by the combination of the tellurium and selenium in the slime with the alkali nitrates added during the smelting operation.

Pure tellurium was obtained by reducing the mixture of tellurites and selenites to tellurium and selenium, and treating this product successively with small portions of nitric acid (20° B.) which had been previously saturated with chromic acid. The action is violent at first, and care should be taken not to add too much of the oxidizing mixture at one time. When the tellurium has all been oxidized to telluric acid, the solution is evaporated, nitric acid being added in large amount when the point of crystalization is reached. Telluric acid is insoluble in nitric acid, while selenic acid is readily soluble, and after the separation of the telluric acid by filtration, and its purification by washing and recrystallization, large flat hexagonal plates of great beauty and purity are formed, having the formula $H_2TeO_4\,2H_2O$. From this telluric acid the pure elementary tellurium may be reduced, or the telluric acid may be converted into tellurous oxide by heating to bright redness in a platinum dish, as expressed by the following equation:

$$H_2TeO_4,\ 2H_2O + \text{heat} = TeO_2 + O + 3H_2O.$$

and the oxide can then be converted into sodium telluride by fusion with pure carbonate of sodium and charcoal. Apparatus was so arranged that the sodium telluride could be dissolved, filtered, and recrystallized in an inert atmosphere of hydrogen or illuminating gas, this precaution being necessary on account of the fact that the alkali tellurides decompose on contact with air. Beautiful crystals of sodium telluride were produced by the method described, and from these pure tellurium was prepared by

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passing a current of air through the solution until all the sodium telluride had been decomposed. The precipitated tellurium was washed carefully, and after drying was melted and cast into bars.

Hydrogen Telluride.

Hydrogen telluride may be produced by digesting telluride of potassium with hydrochloric acid, or by digesting the tellurides of iron or zinc in the same manner. Hydrogen telluride is also produced when tellurium is used as the negative electrode in the electrolysis of water.

I have found in the telluride of aluminum a convenient source of this gas, which is given off by the decomposition of the aluminum telluride with water, according to the reaction:

$$Al_2Te_3+6H_2O=Al_2(OH)_6+3H_2Te.$$

The decomposition of the aluminum telluride is complete, even in the cold, and a constant stream of gas may be obtained by regulating the water supply so that it falls upon the telluride, a drop at a time.

Alkali Tellurides.

In this group the tellurides of ammonium, sodium, potassium and lithium were prepared. Ammonium telluride was prepared by passing hydrogen telluride into concentrated ammonia solution, and also by the reaction between barium telluride and a saturated solution of ammonium sulphate. The tellurides of sodium and potassium were prepared by fusing pure metallic tellurium with twice its weight of the carbonates of sodium or potassium, and one-tenth its weight of charcoal. The telluride of lithium was prepared in a similar manner. The tellurides of sodium, potassium, and lithium all behave very much alike, and all form purple solutions, in color much resembling that of permanganate of potash. The color of the solution of ammonium telluride is pink, in marked contrast to that of the other three tellurides just mentioned.

Tellurides of the Alkaline Earths.

These tellurides are obtained with greater difficulty than those of the alkalies, as they fuse at a much higher temperature, none of them fusing much below the melting point of gold, and some of them, such as calcium telluride and magnesium telluride not even melting at this high temperature.

Magnesium telluride was prepared by melting tellurium under a cover of powdered charcoal, and thrusting successive portions of magnesium ribbon into the fused tellurium. When cold, the crucible is opened, and the magnesium telluride will be found as a grayish brown, almost black, sintered mass. It dissolves in water with a slight odor of telluretted hydro-

gen, and has the characteristic purple color of the soluble tellurides. While not as soluble as the alkaline tellurides, it decomposes more easily.

Calcium telluride was prepared by heating calcium carbide with tellurous oxide, the best proportions being one part of carbide to four or five of tellurous oxide. An explosion was expected to result from the reaction of the carbide with the tellurous oxide, but the only result observed was a flash, such as occurs when nitre is heated with carbon.

Barium telluride was prepared by heating together barium hydroxide and metallic tellurium in the presence of carbon. Strontium telluride was formed by heating for half an hour 20 grams of salycilate of strontium and 7.5 grams of oxide of tellurium, at a white heat. The tellurides of calcium, magnesium, barium and strontium are all decomposed by air, and by carbonic acid or any stronger acid, and by alcohol. In many respects they closely resemble the corresponding sulphur compounds.

Tellurides Insoluble in Water.

Aluminum telluride was prepared by melting aluminum, and then throwing in small pieces of tellurium from time to time. Previously aluminum telluride has always been prepared by heating a mixture of powdered aluminum with tellurium, the reaction being under these circumstances a very violent one. The method I used obviated this difficulty, and also produced the substance in greater purity, the molten aluminum telluride separating perfectly from the excess of aluminum in the crucible. Iron telluride was prepared by the heating together of one part of iron with two parts of tellurium. The resulting telluride is a fusible crystalline body, closely resembling the corresponding sulphide. Zinc telluride is produced when zinc and tellurium are brought together in the molten state. Cadmium telluride is similarly prepared, and so is also copper telluride. Chromium telluride was prepared by heating together chromium and tellurium. The resulting compound was infusible at ordinary furnace temperature, and was unaffected by acids.

Tellurides Found as Minerals.

Lead telluride (Altaite) silver telluride, (Hessite) and gold telluride (Sylvanite) were all produced in crystalline form, resembling the natural crystals. Lead telluride was prepared by melting tellurium with a large excess of lead, and then subjecting the ingot to electrolysis in a bath of lead acetate. The uncombined lead dissolved, leaving the cubes and octahedrons of altaite in the bath. Hessite was produced artificially by adding tellurium to molten silver, allowing it to cool slowly, and then subjecting the resulting alloy to electrolysis in a solution of silver nitrate to which a small amount of free nitric acid is added. Gold teluride was prepared by fusing together tellurium, gold and sodium telluride, and allowing the mass to cool slowly. The sodium telluride present is insufficient to form

the double telluride with all the gold present. The melt was dissolved in water, in an inert atmosphere, and the residue washed and examined under the microscope. The gold telluride was seen as a crystalline mass, but no perfect crystals were formed.

When copper telluride was dissolved in a bath of molten lead, allowed to cool slowly, and electrolysed in a bath of lead acetate, some beautiful crystals were obtained. They resemble iron pyrites very closely, both in appearance and crystalline form, and analysis shows them to be a double telluride of copper and lead. No corresponding mineral is known.

In concluding this paper attention is called to the very interesting field for investigation opened by the method described of producing crystals of metallic compounds in a molten mass of the metal, and then removing the uncombined metal by electrolysis. There can be but little doubt that the sulphides, selenides and antimonides can also be produced by this method, and a promising field for study is thus offered.

INVESTIGATION OF THE PHENOMENON OF DELIQUESCENCE AND OF THE CAPACITY OF SALTS TO ATTRACT WATER VAPOR.

By Charles Russell Ely, B.A., M.A.*

The earliest literature bearing upon the subject was found in the Alchemia of Andreas Libavius, published in 1595, in which considerable space is devoted to a description of deliquescence, but it is all of a qualitative character. The first experimental work appears to have been carried on by John Leslie in 1803. Various earths and stones were exposed to the atmosphere and the amount of water absorbed by each was noted. No definite chemical compounds, however, appear to have been employed. In 1812 there appeared in Annales de chimie. 82 (1) 171-177, a paper by Gay Lussac on an "Investigation concerning the deliquescence of substances." This important paper appears to have escaped the notice of later investigators. Full justice cannot be done it in the short space which can be given to its consideration in this abstract, but several important facts may be noted. Thus the desirability of exposing the salt under investigation to a saturated atmosphere is pointed out. Under these conditions many substances not previously considered to be deliquescent were found to possess this property to a marked degree. The necessity of recording changes in temperature is shown. Finally it is stated that the elevation of the boiling point of an aqueous solution, saturated with any salt at a given temperature, determines its relative attraction for water vapor at that temperature when exposed to an atmosphere saturated with moisture, as compared with other salts under similar conditions. No single salt solution was found to have a lower boiling point than water. The full data upon which Gay Lussac bases his conclusions are not given by him. In 1827, Brandes published in full, in Schweigger's J. 51, 433, the data for a considerable number of experiments performed by him, in an article entitled "Contribution to the knowledge of the Relationship of Water to Salts." Twenty three salts, in an anhydrous state, were exposed under similar conditions to an atmosphere saturated with moisture and the gain in weight noted, after an exposure varying from 2 to 220 days. No statement is made concerning the purity of the salts employed, and the variations in temperature and pressure are not given.

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No further work appears to have been undertaken, of a quantitative nature at least, until 1884, when C. E. Munroe, gave in the Proc. A. A. A. S. 33, 179, the results of his investigations concerning the attraction for moisture possessed by calcium chloride and bleaching powder. Careful analyses were made of the material used and variations in temperature and pressure were recorded. Small portions of the substance employed were taken and an absorption of moisture was noted far greater than that given by Brandes. In 1897, H. W. Hake, as a result of experiments with 14 different salts and with sulphuric acid, exposed to an ordinary atmosphere, announced in the Proc. Chem. Soc. Lond. 13, 147, that he had found that deliquescent salts form definite hydrates under these conditions and he concludes that the phenomenon of deliquescence was due to this tendency. The work of the present writer and that of F. W. Smithers Am. Chem. J. 19, 227, 1897, alluded to below do not furnish any evidence in support of Dr. Hake's conclusions. It is, however, proper to state that his papers were given as preliminary notices and that the data from which he reasoned were not given in full. The paper by F. W. Smithers already referred to, shows that, in the case of a number of deliquescent chlorides and nitrates, no tendency to form definite hydrates could be detected, when the salts or their solutions were exposed to a somewhat moist atmosphere.

In the present investigation, two sets of experiments were carried on. In the first set a number of salts were exposed to an ordinary atmosphere within a large open hood. The atmosphere was kept from becoming dry by exposing dishes containing water within the hood. Each salt was placed in a shallow flat bottomed dish, of uniform surface, 3.8 cm. in diameter and about 1.5 cm. in height, made by cutting off the top of a glass beaker. The purity of each salt was determined qualitatively and the amount of anhydrous salt ascertained by analysis. Readings of the wet and dry bulb thermometer and barometer were taken every day, with a few exceptions, while salts, exposed to an ordinary atmosphere, were being investigated. In the second set of experiments the vessels containing the salts were exposed separately in four in., closed desiccators, the bottoms of which contained pure water. The salts exposed to an ordinary atmosphere were: calcium, barium, strontium, magnesium, zinc, cadmium, lithium, ammonium, sodium, potassium, ferric, cobaltous, nickelous and cupric chlorides; and lithium potassium and sodium nitrates. The salts exposed to an atmosphere saturated with moisture were those mentioned above and, in addition, the chlorides of caesium and rubidium; and the sulphates and carbonates of lithium, sodium and potassium. In the case of the compounds exposed under the hood the change in weight was observed for periods ranging from 10 to 28 days for most of the salts employed. In a few cases a final weighing was made after an exposure

of 58 days. The more deliquescent salts were observed daily while weighings of the less deliquescent salts were made at intervals of two to five days. Calculations were made and tabulated showing the number of molecules of water present for each molecule of the anhydrous salt at each weighing. As a result of these calculations, it appeared that no tendency could be observed on the part of any salt to form stable compounds, corresponding to definite hydrates, under the conditions of the experiments, as described above. This fails to corroborate the conclusions drawn by Dr. Hake from his investigation. Further than this no general conclusions were formed, and individual behavior only could be noted.

The second set of experiments with the salts exposed to an atmosphere saturated with water vapor proved richer in results than was the case with the previous investigation. The first salt selected for examination was calcium chloride and at this point it was thought desirable to expose some salt not deliquescent under ordinary conditions for the purpose of comparison. Crystallized barium chloride was taken, since, in the first set of experiments, a portion of .8944 gms. had gained a maximum weight of only .0059 gms. of water during a period of 16 days as compared with a gain by an empty dish, exposed under the same conditions, of .0018 gms. The barium chloride readily absorbed water vapor when exposed to a saturated atmosphere, and finally dissolved completely in the water which it had thus attracted to itself, which accords with Gay Lussac's conclusions. It was therefore decided in the following experiments to select for observation similar salts belonging to the same periodic group without regard to their previous record as to deliquescence under ordinary conditions. Stronium chloride was therefore taken together with another portion of calcium chloride and following this the chlorides of sodium, potassium and ammonium were used.

The results of the above experiments were compared in various ways, and it was found that a certain regularity of behavior could be noted when the results were plotted in terms of the time of exposure and the amount of water attracted by a unit weight of each salt in the anhydrous condition. Setting forth the results in graphic form in this manner, it was seen that the curve of absorption of water vapor for $Sr\ Cl_2$ fell below that for $Ca\ Cl_2$. With the chlorides of the potassium group it was found that the curve for potassium chloride showed the least absorption, sodium chloride giving a higher curve and ammonium chloride a still higher one.

Magnesium chloride and calcium chloride were next compared and then the chlorides of lithium and sodium. These experiments showed that magnesium chloride absorbed vapor water more rapidly than calcium chloride, and that lithium chloride was more deliquescent than sodium chloride. Comparing the chlorides of magnesium, zinc and

cadmium, it was found that the magnesium salt was the most deliquescent, the zinc salt next and the cadmium salt the least. Up to this point it had been observed that in any periodic group the attraction for water vapor shown by any salt varied inversely with the atomic weight of the metallic element. In taking up the chlorides of rubidium and caesium which were the next to be investigated, it was thought that the results obtained might differ from those previously secured. It was noted for example that in the literature caesium chloride was described by some authors as deliquescent and it was, therefore, hardly to be expected that it would show a rate of absorption less than that of sodium chloride, yet such proved to be the case. These salts behaved in the same way as those previously taken, sodium chloride attracting the most water, followed by rubidium chloride and then by caesium chloride.

A group consisting of $Co\ Cl_2$, $Ni\ Cl_2$, $Fe\ Cl_3$ and $Cu\ Cl_2$ was next studied and it was found that the order of their avidity for water vapor was $Co\ Cl_2$ first, $Ni\ Cl_2$ second, $Fe\ Cl_3$ third and $Cu\ Cl_2$ fourth. It will be noted that $Fe\ Cl_3$ does not follow the rule as observed up to this point. This was not unexpected for it was doubted whether the ferric salt was properly to be compared with the other salts mentioned, on account of its higher valency. $Fe\ Cl_2$ was not used on account of its tendency to become oxidized. On account of the instability of the compounds or the difficulty of obtaining a sufficient number of compounds belonging to a single group, to make a comparison of value, no other chlorides were examined.

In the next experiments using the nitrates and sulphates of lithium, sodium and potassium, it was shown that the order of attraction for water vapor was lithium salts first, sodium salts second and potassium salts third.

The carbonates of lithium, sodium and potassium were next selected on account of the low solubility of lithium carbonate and here for the first time the general rule found above did not hold, potassium carbonate showing the greatest absorption followed by sodium carbonate and with lithium carbonate taking up the least amount of water. It will be seen that in this case the rate of absorption varied directly with the atomic masses instead of inversely.

To check the results an empty dish was exposed under the same conditions to which the salts were subjected in the foregoing experiments and it showed an appreciable gain in weight. The amount of water deposited was, however, less than one one-hundredth of the weight of water absorbed by the least hygroscopic of the salts. In the earlier work no care was taken to weigh out equal portions of the compound employed, but it having become evident that the relative amount of water taken up in a given time would depend on the weight of the salt taken, a greater amount of any salt requiring a longer time

to absorb a given number of times its own weight of water than would be necessary where a smaller quantity was employed, in the later work as nearly equal weights as possible were taken.

The results obtained in this research indicate a relation between the osmotic pressure of salts in solution and the atttraction of such salt solutions for water vapor. In correlating the results of these experiments with those for osmotic pressure we may regard the air, saturated with moisture, as analagous to the semipermeable membrane employed in measuring osmotic pressures, water being able to pass through it in the form of vapor, while the salt from its nature, is unable to escape from the dish containing it. The number of molecules present in a definite weight of a given substance is equal to the total weight taken divided by the weight of one molecule. Therefore, the number of molecules present in the same weight of different salts will vary inversely as the moleculor weight of each salt, and where we have a series of salts which differ in composition only in one of the radicles in each salt, as for instance in the metallic radicle, the number of molecules present in each case when the same weight of each salt is taken, will vary inversely with the weight of the metallic radicle present. It would therefore appear from the results of this investigation that the rapidity of absorption of water vapor, for a considerable number of salts, varies with the number of molecules of each salt.

In an article in the Jour. Am. Chem. Soc. 21, 411-415, 1899 dealing with an investigation into the surface tension of solutions of lithium, sodium and potassium chlorides, C. E. Lineberger states that the surface tension of the aqueous solutions of these salts varies inversely as the molecular weights of these salts, and that equimolecular solutions have the same surface tensions. In considering the results obtained in this investigation it was thought at first that the rate of absorption of water vapor might depend solely on the solubility of the substance employed, using this term in its ordinary sense. That this is not the case may be seen by the fact that such a soluble salt as $Cd\,Cl_2$ falls below $Na\,Cl$ in its rate of absorption, while $Zn\,Cl_2$ appears to be more soluble than $Mg\,Cl_2$ though its rate of absorption of water in an atmosphere saturated with moisture is less than that of the latter.

The chief results of the investigation would appear to be that

1. The rate of absorption of water by a salt in a saturated atmosphere does not depend on its solubility alone.

2. In a considerable number of similar salts, those belonging to a single periodic group show a rate of absorption of water by each salt that varies inversely with the atomic weight of the characteristic element. This has been experimentally demonstrated to hold true for all the members of the four groups of chlorides, one group of nitrates and one group of sulphates, which I have examined. It holds true also for the members of the same groups mentioned in F. W. Smither's

paper as shown by his data. The single exception thus far noted is found in the behavior of the group of carbonates of Group I, and in this case the rate of absorption varies directly with the atomic masses.

3. The rate of absorption of water vapor, within a Mendeleef group at least, appears, in a large number of cases, to depend on the number of molecules of each salt present.

4. There appears to be a close relation between the rate of absorption of water vapor by a salt and the surface tension of its solution.

CRANBERRY DISEASES.*

C. L. Shear, B.S., M.S.

The American cranberry, *Vaccinium macrocarpum*, has been in cultivation in this country for about three-quarters of a century. The wild plant does not appear to be seriously affected by fungous parasites. At the beginning of this investigation but five species of fungi had been reported as occurring upon this host. As the plant has become more extensively cultivated the conditions and facilities for the reproduction and distribution of its fungous enemies have become much more favorable, while at the same time, the plant itself, by the process of cultivation, has apparently become weakened and more susceptible to disease.

The cranberry is grown chiefly in Massachusetts, New Jersey and Wisconsin. Cranberry diseases are most serious in the southern portion of its area of cultivation; the losses from disease being greatest in New Jersey and least in the bogs of Nova Scotia. Observations seem to indicate that the climatic conditions are chiefly responsible for these differences; the long hot summers of the more southern localities appear to be unfavorable for the most thrifty and hardy growth of the cranberry plant, while at the same time, they afford the most favorable conditions for the development of the particular parasitic fungi which attack it. Several diseases are prevalent. Four are of special importance. These are known as blast, scald, anthracnose and rot.

The blast and scald are caused by the same parasite, a species of *Guignardia*, which has been heretofore unnamed. The name "blast" is applied to that form of the disease which attacks the very young fruit and prevents its development. "Scald" is that form of the disease which attacks the nearly or fully grown fruit, causing it to become softened and worthless.

Anthracnose is due to a species of *Gloeosporium*, which also attacks the fruit, softening and destroying it in much the same manner as the scald.

The rot is produced by a fungus which belongs to an undescribed genus which has been named *Acanthorhynchus* in allusion to the spiny beak of the perithecium. The effect of this fungus, so far as the external appearance of the affected fruit is concerned, is similar to that of the other parasites mentioned.

Previous investigators have attributed these diseases to different causes. Dr. Taylor considered them due chiefly to an excess of acid in the soil and water, causing a fermentation to take place in the fruit. Dr. Halsted recognized the fungous nature of the disease known as scald, but was of

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the opinion that it gained entrance to the plant by way of the root system, and consequently recommended applications to the soil; subsequently he suggested spraying with ammoniacal solution of copper carbonate.

The present investigations have been in progress for the past five years, careful studies having been made in the field, laboratory and greenhouse. Pure cultures of the parasites which have been found infesting the leaves and fruit have been made and their life histories and conditions of growth and distribution carefully studied.

The fungus causing scald and blast has been found to grow readily upon ordinary culture media, but grows best upon sterilized corn meal. There are two spore forms produced during its life history. The first, or pycnidial form produces ovoid, hyaline, pycnospores which are provided with a rather inconspicuous appendage consisting of granular matter which appears to be embedded in a somewhat gelatinous substance. Following the pycnidia, the mature ascigerous stage is frequently, though not always produced. The ascigerous perithecia occur much less frequently than the pycnidia, not only in pure cultures, but also upon the leaves of the cranberry. The perithecia are very similar to the pycnidia in external appearance. The asci are without paraphyses and contain eight hyaline or slightly yellowish ascospores. The fungus in both its pycnidial and ascigerous stages resembles very closely the black-rot fungus of the grape, *Guignardia Bidwellii*. This fungus is quite generally distributed throughout the cranberry-growing sections of this country. It occurs upon the leaves as well as the fruit. Specimens have been found in West Virginia, Massachusetts, Nova Scotia and Wisconsin. The fungus has the peculiarity of remaining for a considerable time in a dormant condition in the tissues of the leaves and fruit. After gaining entrance, the mycelium remains more or less inactive until the conditions of the host, or its environments, are such as to cause its further developement. Much of the decay which takes place in the fruit after picking is due to the development of this dormant or resting form of the fungus.

The disease known as anthracnose is caused by a species of *Gloeosporium* which is apparently very closely related to the forms which attack other fruits, and is regarded as only varietally separate from them. This disease is more prevalent in the northern sections of the cranberry growing area, having been found doing most damage in Massachusetts.

The fungus has been grown in pure cultures on various media, and the ascigerous, as well as the conidial form, has been produced. The conidia resemble very closely those of other species of *Gloeosporium* or *Glomerella*, as described by Stoneman, Clinton and others.

The ascigerous form, which has never before been found in this particular variety, is very similar to that which has been described by Stoneman, Sheldon and others from other fruits. The ascigerous stage has not been found under natural conditions either on leaves or fruit, but has been produced frequently on culture media in the laboratory.

Rot.—Cranberry rot affects the fruit in much the same manner as the scald. At first a small, light-colored spot occurs upon the berry. This spreads and the fruit is finally entirely softened and destroyed. Pure cultures from the mycelium in the interior of the berry are necessary in order to determine positively what fungus is responsible for the injury. The disease attacks the leaves also. It is caused by a fungus which, as previously mentioned, belongs to an undescribed genus, *Acanthorhynchus*. This disease is most frequent in New Jersey; it occurs also in West Virginia, Massachusetts and Nova Scotia. Numerous pure cultures of the fungus have been made on various media, but only the ascigerous form has been produced. The ascospores are rather large, yellowish-brown, and are expelled at maturity with considerable force. This aids in their distribution. Upon germination they produce a peculiar appressorium which attaches itself to the surface of the leaf or fruit and acts as a holdfast while it germinates and sends a germ tube into the tissue.

Besides the three organisms already mentioned, which cause the most injury to the cranberry, about thirty other species have been found upon the leaves, fruit, or other portions of the cranberry plant; some of these are evidently parasitic in habit, while others are either facultative parasites or only saprophytes. These various species have been described and their habits and distribution given. Several of these fungi are undescribed species.

From studies of the life histories of the parasites and their methods of reproduction and distribution it has been possible to devise methods for the prevention or control of the diseases.

A series of careful experiments and tests with various fungicides has been conducted for several years. As a result it has been found that Bordeaux mixture is most effective. Besides liquid applications, dust sprays have also been used, but without any decided benefit. On experimental plats treated with Bordeaux mixture in 1904, according to actual counts made September 8th to 13th, of sound and diseased berries on 35 yard-square plats, representing the average sprayed and unsprayed areas, it was found that the greatest percentage of disease on any of the sprayed plats was 27.5 per cent as against 100 per cent, or a total destruction on the unsprayed plats. The minimum amount of disease on any sprayed plats was 13 per cent as against 89 per cent on the check plats. Under more favorable conditions and with a more thorough and satisfactory application of Bordeaux mixture in 1905, much better results were obtained. Plats sprayed five times, as follows: May 19, June 22, July 14, July 31 and August 15, showed by accurate counts of sound and diseased berries made on September 8, the following results: An average of only 6 per cent of rotten fruit was found on the sprayed plats, while there was a little more than 91 per cent found on the unsprayed plats.

Two other plats sprayed the same number of times, but the first application being made on June 2 instead of May 19, showed as a result an

average of 2.36 per cent of diseased berries on the sprayed plats, and 92.6 per cent of diseased fruit on the unsprayed plats.

As a result of the spraying experiments it has been demonstrated that these diseases can be largely prevented by thorough and proper application of Bordeaux mixture. The conditions under which cranberries are grown differ so greatly from those under which other fruits are grown that it has been found necessary to devise special methods for the handling of the spraying machinery.

It has been found that where large areas are to be sprayed a power spraying outfit is necessary. A gasolene engine with proper pump and accessories furnishes the most satisfactory and economical power. Such an outfit, mounted upon a truck and provided with long leads of hose, may be driven upon a track prepared across the bog, and the mixture applied from both sides, thus necessitating as little tramping and injury to the cranberry bog as possible.

A STUDY IN FILTRATION, WITH TESTS OF METALLIC FELT FILTERS.*

By Martha Maria Brewer, B.S.

Filtration as usually carried out is the separating of a solid insoluble substance from the liquid in which it is suspended. This can be done by means of a porous medium, or filter, of such material as not to be attacked by the substance to be filtered, and which is sufficiently porous to allow the liquid to pass through it, while coarse enough to retain all solid matter. Many different filtering mediums have been used, such as linen, woolen, and cotton fabrics, felt cloths, straw, raw cotton, coarse and fine sand, burnt clay, animal and vegetable charcoal, soft leather, unsized paper, crushed glass, sand, asbestos, and platinum sponge.

As early as 400 B. C., Plato mentions filtering by capillary syphoning, and Aristotle makes mention of water passing through earthen vessels not well baked. Geber, in the ninth century, Rhazes, in the tenth century, and Lulli and Aquinas, in the thirteenth century, all employed filtration in their alchemistic experiments, their method being to hang one end of a felt or woolen cloth in the vessel containing the liquid, and allowing the other end to hang in a vessel placed lower than the first, the liquid then passing through the cloth syphon by capillarity and falling drop by drop into the lower vessel.

Filtering through paper is mentioned by Libavius, in 1595, in his "Alchymia" (sometimes spoken of as the first text-book in Chemistry), and Juncher in a work entitled "Conspectus Chemiae," published in 1730, speaks of filtering through bibulous paper held in a glass funnel. But little improvement in this simple method of filtration was effected until 1858, when Dr. Julius Lowe described a filter using asbestos as the filtering medium, and which could be used in filtering gelatinous and corrosive liquids. In 1860 Professor Böttger employed gun cotton in filtering liquids which would act chemically upon a paper filter.

In 1869 Bunsen devised the method of filtration by means of suction, which was proved of incalculable help in chemical procedure. In an ordinary glass funnel of an angle of 60°, whose walls were free from inequalities, he fitted perfectly a thin platinum foil funnel, upon which was placed the ordinary filter paper. This he moistened and adjusted so that there

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would be no air bubbles between it and the glass. The platinum foil funnel was to prevent the paper filter from tearing under the pressure produced by the air pump.

He now attached an air pump, constructed on the principle of Sprengel's mercury pump, by means of a rubber tube to a narrow glass tube, open at both ends and passing through one of the two perforations of a cork fitted into the flask, while through the other perforation of the cork was passed the neck of the glass funnel containing the platinum foil funnel and the filter paper.

The connections being made and the pump started, the clear supernatant fluid was first poured upon the paper, the filtrate running through in a continuous stream, often very rapidly. The liquid containing the precipitate was now poured on, being careful to keep the filter as full as posssible during the operation. After the precipitate had all been transferred to the filter, it was washed thoroughly by carefully pouring water down the sides of the funnel to within a centimeter above the rim of the filter.

The filter, after the water had been allowed to drain, dried rather quickly, due to the high pressure to which it had been subjected, and could be ignited immediately.

In 1867 Dr. Gibbs described a filter make by choking the throat of a funnel first with coarse fragments of glass, and then placing upon these successive layers of powdered glass or sand, the upper layer being of the finest powder. Most precipitates could be filtered upon this filter without the slightest loss, and be dried with the funnel at any temperature below that at which glass softens, or the precipitates underwent chemical change. This filter could also be used for filtering corrosive substances.

Dr. Gibbs is one of the first chemists to consider the value of the purity of the precipitate, as well as of the filtrate, in separating the two and by the method he described the solid material upon the filter, by being dissolved in some appropriate solvent which would be without chemical action on the pulverized glass, is obtained in perfectly pure form, and entirely uncontaminated by any substance derived from the filtering medium.

The application of Bunsen's method of rapid filtration by means of an air pump, in conjunction with the use of the pulverized glass filters of Dr. Gibbs, marked a great advance in the methods of filtration, and modification of the Gibbs' filter by Munroe, and by Gooch, have brought to their present perfection the methods of filtration.

Munroe devised, in 1871, an improvement in filtration through the use of porous cones of earthenware, and in the course of this work he invented the rubber gasket now in general use for holding crucible filters during the process of forming the filter medium in them, and of filtering with them by means of the air pump.

The improvement effected by Gooch was first described in 1878, and consisted in the use of a platinum crucible, the bottom of which had been perforated by many fine holes, in place of a funnel, and in the use of a com-

pact layer of asbestos fibre as the filtering medium. In preparing this filter, white, silky, anhydrous asbestos is scraped to a fine, short down, then boiled in hydrochloric acid to remove all impurities, and washed thoroughly by decantation with water. Next, a platinum crucible of ordinary size of a broad, low pattern, has the bottom perforated with many fine holes. This crucible is placed in the opening of a Bunsen funnel, over which has been fitted a rubber gasket as devised by Munroe. This funnel, containing the crucible fitted air-tight, is connected with an air pump, and then prepared asbestos suspended in water is poured into the crucible. The water is drawn through the holes in the crucibles, leaving the asbestos deposited in a close, compact layer upon the perforated bottom, more asbestos being poured in until a layer of sufficient thickness is obtained. This improved method of filtration has proven of greatest value in analysis, and is quite generally adopted by chemists everywhere. Dr. Gooch has also described methods of filtration using napthalene, and other easily volatile substances, in place of asbestos.

In 1888 Dr. Charles E. Munroe described a modification and improvement of crucible filters, through the use of a felt or sponge of some reduced metal, as platinum, as the filtering medium, in the perforated bottom of a crucible. Using a platinum crucible and a felt of platinum sponge, this filter had many advantages over other forms of filters, in the excellence of platinum sponge as a filter medium, retaining very finely divided precipitates without loss, and the ease with which the precipitate can later be removed by appropriate solvents, the choice of solvents being wide, on account of the inert nature of platinum toward most reagents. This filter can be used over and over, and even such precipitates as barium sulphate can be retained with perfect success, and, after weighing, can be easily removed without in any way impairing the filter.

Tests of Metallic Felt Filters.

In making the filter I dissolved a small amount of platinum chloride in distilled water, and precipitated the platinum as ammonium platinic chloride in excess of ammonium chloride. I washed the precipitates thoroughly, first with water, and then with alcohol a number of times by decantation, being careful in the last washing to pour off as much of the alcohol as possible without losing the salt. Placing a Gooch crucible, previously cleaned and dried, upon several layers of bibulous paper, I pressed it down tightly with one hand and with the other quickly poured in the moist salt. I did not relax the pressure on the crucible until the alcohol had apparently been absorbed, leaving the precipitate dry upon the bottom. By this means I found, when I lifted the crucible from the paper, that not a particle of the salt had been lost by passing through the perforations.

In igniting the salt I took the precaution to dry it in the steam heater for a few minutes or over a very small Bunsen flame placed at some little

distance from the crucible. Before the final ignition over the Bunsen flame I gently pressed down the edges of the salt with a rounded glass rod, thus causing the resulting sponge to adhere more tightly to the sides of the crucible and lessening the probable curling of the edge. Igniting gradually, the volatile constituents were driven off, leaving a coherent layer of metallic platinum. With care in preparation, no cracks will appear, but when they do they may be closed by gently rubbing with a glass rod, or by adding a new portion of ammonium platinic chloride and repeating the drying and ignition.

The filter is now ready for use. In using the filter I found its application very wide. All substances which do not form an alloy with platinum when ignited, and which are soluble either in alkalies, at the ordinary temperatures, or acids, aqua regia alone being excepted, can be filtered upon this filter. Substances that do form an alloy with platinum on ignition, such as lead when weighed as the sulphide, I find can be very accurately estimated as the carbonate by heating in the steam oven, without affecting the platinum sponge in the least. Silver chloride, heated in the steam oven, gave good results. Very fine precipitates, such as calcium oxalate and barium sulphate, were collected upon the filter without the filtrate even being cloudy the first time running through.

Tests of a practical character, through the use of this filter in the varied determinations of quantitative analysis, gave most excellent results. Among many analysis made to test the practical working of the filter, may be mentioned the following: Determination of calcium in calcite, first as calcium carbonate, and then as oxide, by ignition of the carbonate; determination of manganese in manganous sulphate as manganous pyrophosphate; determination of lead in lead oxalate as lead carbonate; determination of magnesium in magnesium sulphate as magnesium pyrophosphate; determination of iron present as an impurity in calcite; determination of silver in silver nitrate as silver chloride; determination of arsenic in arsenious acid as arsenic oxide; determination of copper in copper sulphate as copper oxide; determination of barium in barium carbonate as barium sulphate, etc., etc. No difficulty was experienced in completely collecting and holding even the most finely divided precipitates, and after each determination it was found easy to dissolve in some appropriate reagent the substance on the filter, leaving it ready, after drying and ignition, for further use. The use of these filters was found to answer admirably, in all these varied determinations, as simple and expeditious means for the collection and weighing of the precipitates formed, answering in an eminently satisfactory way all of the requirements of quantitative analysis.

A NEW AMERICAN MOSQUITO.

Clara S. Ludlow, B.Sc., M.Sc.*

Throughout the northern part of the United States and probably throughout the southern part of Canada is found a group of mosquitoes belonging to Theobald's *Grabhamia* in which, so far at least as the adults are concerned, some species run very closely together, the markings of the individuals in one species closely resembling those of another, so closely indeed that the line of division is not easily seen.

The common characteristic is the abdominal marking, which may be said to be light colored, with a pair of submedian dark spots on some—at times all—the segments. Here too, the individual variation in a given species is very great, as for example G. *Curriei* Coq., where these spots may occur as in the type, or on a couple less or on one or two more of the segments.

The forms which run most closely together have also banded legs, the banding including both sides of the joints on some if not all the legs, e. g. G. *Curriei* Coq. G. *lativitta* Coq. and the final hind tarsus is often light when seen from one direction and brown from another, so that it is just possible that *dorsalis Meigin.* may be found among them.

What the larval differences may be is only partly known, and the division into coast and inland species does not seem satisfactory, for specimens which cannot be distinguished from *lativittata* Coq. (originally taken on the Pacific coast) are taken in Wyoming where no salt water nor salt marshes exist, and taken in numbers that seem to preclude the idea of transportation. Other forms, evidently very intimately related to *Curriei*, Coq. possibly a smaller and much lighter variety of it, are taken further east, even on the Atlantic coast, and the ultimate placing of these is still to be worked out. It may be that larval differences will decide.

Grabhamia Spencerii Theobald, and *G. Spencerii var. Idahoensis* have unbanded legs, and lately there has been studied a form apparently new, from Fort Keogh, Montana, which has the legs basally banded only, but in no wise resembles *sollicitans*.

Grabhamia nigromaculis n. sp.

♀. Head very dark brown, almost black, covered with ochraceous broad curved scales on the vertex and occiput, a triangular spot of slender golden brown curved scales immediately laterad, followed

*In candidature for the Ph.D., degree.

by flat, white, then brown, lateral scales and light scales towards the ventral surface; white bristles and very slender, long scales projecting forward between the eyes, a heavy bunch of pale forked scales in the nape; antennae dark brown, verticels very dark brown and sparse, pubescence white, basal joint very dark brown with flat scales; palpi very dark brown; proboscis very dark brown with a tiny white spot (sometimes an indistinct white band) on the apical part of the proximal third of its length, a few white scales at the base, apex dark; eyes dark blue, red iridescence; clypeus very dark.

Thorax almost black; prothoracic lobes covered with long rather slender spatulate white scales and light bristles; mesothorax with a median third of slender curved golden brown scales, pale on the curved half, and the outer thirds with rather broader pale ochraceous scales; a bunch of pale bristles over the wing joint and a few dark ones near the "bare space;" scutellum very dark (black) with pale ochraceous slender curved scales and pale bristles; pleura very dark brown with white spindle shaped and long flat scales, and pale bristles; metanotum very dark brown.

Abdomen very dark, covered with very dark brown, practically black, and pale ochraceous scales, i. e., pale basal and very narrow apical bands, a median ochraceous stripe on most of the segments, white lateral spots and a few pale scales scattered in the dark submedian spots; the dark spots on the apical segments are much reduced so that these segments are mostly pale scaled. Ventor mostly pale scaled.

Legs: Coxae and trochanter dark, covered mostly with white scales, a few very dark ones and some dark bristles; femora ventrally light, dorsally speckled nearly evenly black and white, light towards the base, and almost black just proximal to the tiny apical light spot which very slightly includes both sides of the joint; tibiae much as femora, more distinctly dark towards the apex; metatarsi speckled, darker than the tibiae, and having a basal white band, very narrow in the fore leg; all the tarsal joints are dark and in the fore and mid legs the first and second tarsal joints have tiny basal white spots; in the hind legs all the tarsal joints are basally white banded, the band on the fourth joint very narrow. Ungues large and equal, both uniserrate.

Wings clear with dark brown and white scales, speckled; the ventral scales all white. First, submarginal cell a little longer than, and about half the width of the second posterior cell; *mid* and supernumerary cross veins meet and are about equal, posterior cross vein about the same length as, and its own length distant from mid. Halteres with light stem and dark knob.

Length. 8-8.5 mm.

Habitat. Fort Keogh, Montana, Fort Lincoln, N. D.

Taken. Fort Keogh, Sept. 1-8., July 12-27.

BIBLIOGRAPHICAL RECORD.

September 1, 1905, to December 1, 1906.

This Bibliographical Record is the second annual Supplement to the University Bibliography, containing titles of books, monographs, papers, etc., published by members of the Faculty and Doctors of Philosophy, issued September 1, 1904. It embraces titles of publications by University instructors and graduates appearing during the past year, and complete lists of the publications of members of the Faculty whose names were not included in the Bibliography of 1904, or the 1905 supplement. The abbreviations used are current in scientific publications.

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SCIENTIFIC NOTES.

Dr. Theodore Gill, Professor of Zoölogy, has prepared an elaborate article entitled "Parental Care Among Fresh Water Fishes," for the Smithsonian Report for 1905. It is already in type but not yet in page form; it will constitute nearly 150 pages and include nearly a hundred figures. The author affirms:

"Many important details respecting the life histories and parental care of a large number of other fishes have been published from time to time and may be found in the publications of various societies or other periodicals, but such are closed books to most persons. Anyone who looks for information in the popular works on natural history of the day must inevitably be disappointed at the meagerness of the information given. Even in the voluminous German work, so well known as Brehm's Tierleben, the information is meager for almost all fishes, and especially meager for American forms. The sources of knowledge have not been discovered by the compilers of such works, but he who might judge from the paucity of data that no others could be found would be much deceived. To uncover some of the interesting details hidden in comparatively little known journals and other works is the object of the present article, which is devoted to the record of facts about the mating and breeding habits of some among many remarkable species. It is hoped that the information given may indicate points to be observed in the history and economy of other species, as well as of those already noticed. There is, indeed, an urgent call for corroboration and amplification of most of the histories given, as well as for discovery of the natural history of other species."

Professor Merrill's "Contributions to the History of American Geology," issued in April of this year has received many flattering notices of approval, both at home and abroad. We quote from personal letters:—"It is unique, and a veritable treasure house of well arranged facts concerning American geology and American geologists," "A complex and difficult subject has been handled with much skill and thoroughness, and all who are interested in American geologists and the work they have acomplished will be grateful for this presentation." Again, "Sir Archibald Geikie and the late Professor Zittel have already provided geologists with historical accounts of the growth of their subject, mainly from the European standpoint. In these 'Contributions' Mr. Merrill takes up the story from the American point of view, thereby filling a serious gap in a manner that will earn the gratitude of everyone interested in the science." (Nature, London, England, August 2) "This

record of the birth and growth of geology in the United States and Canada written by one of the most able and indefatigable of workers is of exceptional interest. (*Geol. Mag.*, July).

In his article on "DYNAMITE: THE POWER UNTAMABLE" in the *American Magazine* October, 1906, the author, Samuel Hopkins Adams, alluded to Professor Charles E. Munroe, head of the Department of Chemistry and Dean of the Faculty of Graduate Studies, as follows:

"The most skillful handler of high explosives in this country is Dr. Charles E. Munroe, of Washington, who has for many years been the Government's expert. He has devised the method of testing iron work by dynamite, the explosion unerringly detecting the fraudulent building-up of armor by separating the core from the outer layers and he also made a collection of explosive engravings which are as beautiful as they are wonderful. Perhaps the most perfect of them is that of a young maple leaf. This was laid upon a bar of iron, and a cylinder of gun-cotton placed over it and fired. There appeared in the iron at the spot where the gun-cotton stood, a circular depression, one eight of an inch in depth, a trifle larger than the circumference of the explosive. In the center of this the leaf was reproduced, perfect in every detail even to the finest fiber. A leaf of magic and a work of art not to be surpassed in all the wonder-world of science! Even more intricate is a lace design in Dr. Munroe's collection. To produce this a bit of delicate oriental lace was sacrificed. The explosive transferred its dainty traceries entire to the metal. Coins are also recorded with remarkable fidelity, the entire design on one side being faithfully reproduced. But—and herein is the astonishing feature—the coin, the leaf fiber and the lace are not *imprinted* as they would be if a sudden weight would be driven down upon them; they are reproduced in the iron with every detail of impression and relief just as it was in the original. Thus the fiber of the leaf stands forth on the metal; the filaments on the lace project; the lettering on the coin *juts out* from the engraving. Take the "tails" side of a copper cent for a subject. The piece is placed on the metal "heads" up and the gun-cotton exploded upon it. The wreath, the coat of arms and the letters "one cent," all appear in bas relief, just as on the coin, except, of course, that they are reversed in order. To put it in its simplest form, the engraving is precisely the same as the image of the cent reflected in a mirror. Incidentally the coin is entirely consumed and passed away in gasses by the great heat generated. A beautiful variation of this experiment is to detonate the explosive inside a tin can containing water and placed upon a body of iron. The iron shows, in miniature, the succession of waves as produced by the eruption of a submarine mine, every tiny ripple having been caught as it rolls to the shore, and fixed in the imperishable metal, from which it rises, crested and perfect.

"In his experiments at safe-breaking, for the Treasury Department, Dr.

Munroe has shown that high explosives act most violently along lines of vacancy. A cylinder of gun-cotton detonated upon a large mass of iron will produce a shallow and uniform depression. Take a similar cylinder and bore a hole through the center. Now explode this above the iron, and opposite the perforation a deep hole of substantially equal diameter will be found in the metal. In his experiments upon safes for the Treasury Department, Dr. Munroe attacked a safe of 28 inches cube, with walls made of steel and iron plates, reinforced on each edge, using several sticks of dynamite. The result was nil. Taking an equal number of sticks, he fastened them around a tin can, set the can on the safe, mouth downwards and fired the charge. A 3-inch hole was blown clean through to the interior. The expert explained this on the ground that the force of the explosive was exerted through the hollow space as through the bore of a gun.

"Dr. Munroe advocates thoroughly a national law regulating the use of high explosives. At present there is nothing of the sort and the mortality from this cause greatly exceeds that in England, where there is a general and rather liberal ordinance."

In recognition of the universal interest in the matter of pure food, we are glad to publish the following abstract bearing on the "Effect of Salicylic Acid as a Food Preservative on Digestion and Health," by H. W. Wiley, M.D., Ph.D., who is Professor of Agricultural Chemistry in the Faculty of Graduate Studies in this University, as well as Chief of the Bureau of Chemistry. This abstract is based upon the detailed report published as Bulletin 84, Part II, Bureau of Chemistry, U. S. Department of Agriculture, Influence of Food Preservatives and Artificial Colors on Digestion and Health, and Circular 31.

The increasing interest in the question of the purity of food products, especially evinced by the enactment of the food and drugs act, and the meat inspection amendment, makes it the more imperative that it should be possible to state with authority whether extraneous substances added to foods, such as food preservatives and artificial colors, are or are not "injurious substances added to foods." It is thought that the feeding experiments conducted by the Bureau of Chemistry, Department of Agriculture, afford such an authoritative answer. The twelve men who belonged to the table at which the salicylic acid was administered, for a period of thirty days, received amounts varying from 0.2 grams to 2 grams per day, the total amount taken by each individual amounting to 10 grams. Every effort was made to render the conditions uniform, and a close check was kept on all possible changes by means of physical, chemical and microscopical examinations. The body weight and the effect produced on the nitrogenous elements of the urine were especially studied, the metabolism of nitrogen, phosphoric acid, sulphur, fat, and total solids being carefully studied and the body balance in each case de-

termined. As the results of this study the following general conclusions have been reached:

There is a well developed tendency during the administration of salicylic acid to increase the store of phosphoric acid in the body, while in the case of nitrogen no marked effect is produced altho there is a slight tendency to increase the digestibility and absorption of the nitrogen ingested. The data as a whole shows very clearly that salicylic acid exerts an exciting influence upon the activities which take place in the alimentary canal, stimulating the organs to greater effort, and this stimulation leads at first to increased digestion and absorption of the foods which are introduced into the stomach. In the light of the data which are exhibited salicylic acid may be said to increase the solubility and absorption of the food in the alimentary canal so that larger parts of the nutrients taken into the stomach actually enter the circulation.

The data which show the effects just noted, however, also indicate that the general effect upon the system is depressing, in that the tissues are broken down more rapidly than they are built up, and thus the normal metabolic processes are interfered with in a harmful way. The administration of the salicylic acid is attended by a gradual decrease in the weight of the subjects, altho the quantity of food elements administered during the preservative and after periods is slightly increased, which fact, together with a greater degree of absorption of the food elements, should have resulted in a slight increase in weight. This increase in weight, however, does not occur, and the disturbing influences of the salicylic acid upon metabolism, altho not very great, are specifically demonstrated.

The final conclusion in this matter, therefore, is that the unenviable position which salicylic acid has heretofore held among preservatives, in being regarded as the most injurious of all, is perhaps to a certain extent undeserved. Like other ordinary preservatives, it is not one which can be classed as a poison in the usual sense of the word. When used as a medicine in many cases of derangement of health it is, like the other chemical preservatives, often highly beneficial when properly prescribed by a competent physician. It is, when used in the food, at first an apparent stimulant, increasing the solubility and absorption of the common food elements from the alimentary canal. It soon, however, loses its stimulating properties and becomes a depressant, tending to break down the tissues of the body more rapidly than they are built up. It disturbs the metabolic processes, in most cases producing conditions which are not normal and which apparently are not beneficial. It has a tendency to diminish the weight of the body and to produce a feeling of discomfort and *malaise* which, while not marked, is distinctly indicative of injury. In some cases these symptoms of *malaise* approach illness, and while not always diagnostic are sufficiently common to unmistakably point to the salicylic acid as their origin. It places upon the excretionary organs, especially the kidneys, an additional burden which they are not able to

bear and which can not possibly result in any good, but on the contrary must necessarily, by thus increasing the burden of the kidneys, finally result in injury, tho perhaps with the use of very small quantities of the preservative these organs would continue to perform their functions for many years before finally breaking down.

Apart from the known physiological effect of the preservative there are general considerations which render its use inadvisable, and there appears to be no necessity for its use, as food can be preserved in unobjectionable ways without its aid. Its indiscriminate use would tend to carelessness in the quantities employed, thus increasing the dangers to which the consumer is subjected. Also its use in the preservation of foods tends to induce carelessness and indifference on the part of the manufacturer, as when a chemical antiseptic is employed many of the processes necessary to the proper selection, cleaning, and preservation of foods may be omitted. The addition of salicylic acid and salicylates to foods is therefore a process which is reprehensible in every respect and leads to injury to the consumer, which, tho in many cases not easily measured, must finally be productive of great harm.

UNIVERSITY APPOINTMENTS.

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B.S., Cooper Institute, 1899, Assistant in Physics, Ibid., 1899-1900; Assistant Electrical Engineer, Siemens Bros. & Co., Ltd., England, 1902-1904; A.M.I.E.E., London, 1904; Chief Instructor Electrical Engineers Institute of Corr. Instruction, 1904-5; Electrical Engineer Bullock Elec. Mfg. Co., 1905-6.

Instructor in Greek and Latin: CHARLES B. NEWCOMER, Ph.D.

A.B., 1889, M.A., 1890, University of Nebraska; 1890-'91, Student Universities of Berlin and of Nancy, France; 1891-'92, Professor of Greek and Latin, Cotner University, Bethany, Nebr.; 1892-'95, Master in the Belmont School for Boys, Belmont, Cal.; 1895-'99, Student of Classical Philology and Archaeology, University of Berlin, Ph. D., Ibid., 1899; 1899-1901, Acting Asst. Professor of Latin, University of Missouri; 1901-'04, Professor of Greek, Drury College, Mo.; 1904-'05, member of the American School of Classical studies at Athens; since Sept. 1905, Instructor of Greek and Latin, University of Michigan. Member Phi Beta Kappa, American Philological Association, etc., etc.

Instructor in Mathematics: GEORGE ALBERT ROSS, A.M.

A. B., William Jewell College, 1893; Professor of Mathematics, Grand River College, Gallatin, Mo., 1893-95; President, Clarksburg College, Mo., 1895-96; Professor of Mathematics, Hardin College, Mexico, Mo., 1896-97; Graduate Student Columbian University, 1897-99; A. M., Ibid., 1898; Vice President and Professor of Mathematics, Hardin College, 1899-1906. Member of The American Mathematical Society.

Professor of Morbid Anatomy: ISAAC WRIGHT BLACKBURN, M.D.

M.D., University of Pennsylvania, 1882; Pathologist to Government Hospital for the Insane, since 1884; Lecturer on Pathology of Mental Diseases, Georgetown University, 1885-'86; Professor of Pathology, Ibid., 1886; Professor of Pathology and Histology, Ibid., 1889; Professor of Morbid Anatomy and Special Pathology, Ibid., 1898;

Member of the American Medico-Psychological Association, Corresponding Member of the Philadelphia Pathological Society; Member of the American Association for the Advancement of Science, and other medical and scientific societies.

N. B. The academic record of Professor Blackburn is republished from the Oct. '06 Bulletin to correct the error in stating that he was lecturer, professor, etc., since 1885 in The George Washington instead of Georgetown University.

UNIVERSITY MISCELLANEA.

Dr. George P. Merrill, Professor of Geology, gave the presidential address before the 184th meeting of the Geological Society of Washington, held at the Cosmos Club on December 19, 1906. His theme was, "The Composition and Structure of Meteorites Compared with those of Terrestrial Rocks."

A second edition, revised and enlarged, of the Principles and Practise of Agricultural Analysis, by Dr. H. W. Wiley, Professor of Agricultural Chemistry, is in press (Chemical Publishing Company, Easton, Pa.), and Vol. I, on Soils, 636 pages, has just been issued.

Dr. N. Monroe Hopkins, Asst. Professor of Chemistry in charge of electrochemistry was appointed "Electrical Engineer" by the Secretary of the Navy December 19, 1905, and placed in charge of the engineering work involved in the consolidation of power plants at the various Navy Yards and Naval Stations throughout the United States Naval Service. This consolidation of power plants was authorized by a recent act of Congress.

Walter C. Clephane, Professor of Law, has recently been appointed by the Commissioners of the District of Columbia, one of the three delegates from the District to the conference of Commissioners on Uniform State Laws, a conference which is closely in touch with the American Bar Association. This follows a previous appointment by the District Commissioners as a delegate from the District of Columbia to the Congress on Uniform Divorce Legislation, a session of which was held in Philadelphia in November.

James Brown Scott, M.A., J.U.D., Professor of Law, is general editor of the American Case Book Series (West Publishing Company), which is to comprise thirty-two volumes. Professor Scott was elected Secretary of the American Society of International Law, recently organized, and has been selected as managing editor of the *American Journal of International Law.*

The last meeting of the New York Section of the Society of Chemical Industry was held at the Chemists' Club, 108 55th street, November 23. There was an informal discussion of "Denatured Alcohol" and an exhibition of it in operation. Professor Charles E. Munroe, head of the Department of Chemistry, Dr. H. W. Wiley, Professor of

Agricultural Chemistry, and Dr. C. A. Crampton, M.D., 1884, of this University took part in the discussion.

Mr. Joseph William Fell, B.S. (Trinity College) 1889, M.S (G. W. U.) 1897, died on December 15, at Saranac Lake, New York. Since graduation from this university Mr. Fell has served as chemist at the U. S. N. Smokeless Powder Plant at Indian Head and on the Geological Survey of North Carolina.

Miss Alice B. McKelden, Ph.D. (A.B., G. W. U., 1899), addressed the Association of Teachers of Mathematics in the Middle States and Maryland, December 1, on "The Problems that Arise in the Teaching of Elementary Algebra."

The joint meeting of the American Philological Association and the Archaeological Institute of America will be held in the halls of this University, January 2-5, 1907.

The Department of Politics and Diplomacy of the George Washington University, which was organized in 1898 in close affiliation with the Law Department, has recently been intrusted to the general direction of Professor C. W. A. Veditz as acting dean. Professor Veditz is now engaged in the elaboration of a plan for the complete reorganization of the Department with graduate and under-graduate courses. These courses will resemble the courses offered in other institutions in the Departments of Commerce and of Political Science. The under-graduate course will retain the cultural courses usually required of candidates for the bachelor's degree but with especial emphasis upon work in history, economics, political science and public law. In the reorganization of the school the endeavor has been made to combine the successful features of the School of Political Science at Tuebingen, Germany, of the School for Political Science in Paris, and of the Wharton School of Finance and Commerce of the University of Pennsylvania.

It is interesting to note that Columbia and Yale Universities have recently combined in the organization of courses to prepare men for the foreign service as diplomats or consuls and that throughout the country several universities have recently created new Departments of Economics and Political Science. Thus the University of Illinois has started a college for higher business education, the University of Kansas has inaugurated a similar enterprise and the Washington and Lee University is now establishing a School of Commerce. The credit, however, for the first creation of a distinct department for the purpose of preparing men for the public service belongs to the George

Washington University, inasmuch as the Department of Politics and Diplomacy was started here in 1898 and has already graduated 500 men.

A class of trained nurses was graduated December 19, from the School of Nurses of The George Washington University at the regular Wednesday noon Assembly held in Assembly Hall. This is the second section of the class of 1906. The first class was graduated last spring. Those who received their certificates were: Misses Edna May Henson, W. Va.; Rachel Christian Trimble, Va.; Rebecca H. Blue, W. Va.; Mary Elizabeth Stevens Hardy, Va.; Mary Elizabeth Morgan, Va., and Florence Estelle Miller, N. Y. The address on this occasion was made by Dr. Wm. A. White, Superintendent of the Government Hospital for the Insane. The graduating class received their certificates from Dr. Needham, President of the University. They were presented by Dr. Phillips as Superintendent of the Hospital.

This School of nurses was opened in the spring of 1903. The course comprises three years of instruction and nursing. Among those present on the platform were Miss Struble, Superintendent of Nurses, several of the head nurses, members of the Faculty of Medicine and a large representation from the faculties of the various departments.